SCIENTIFIC AMERICAN

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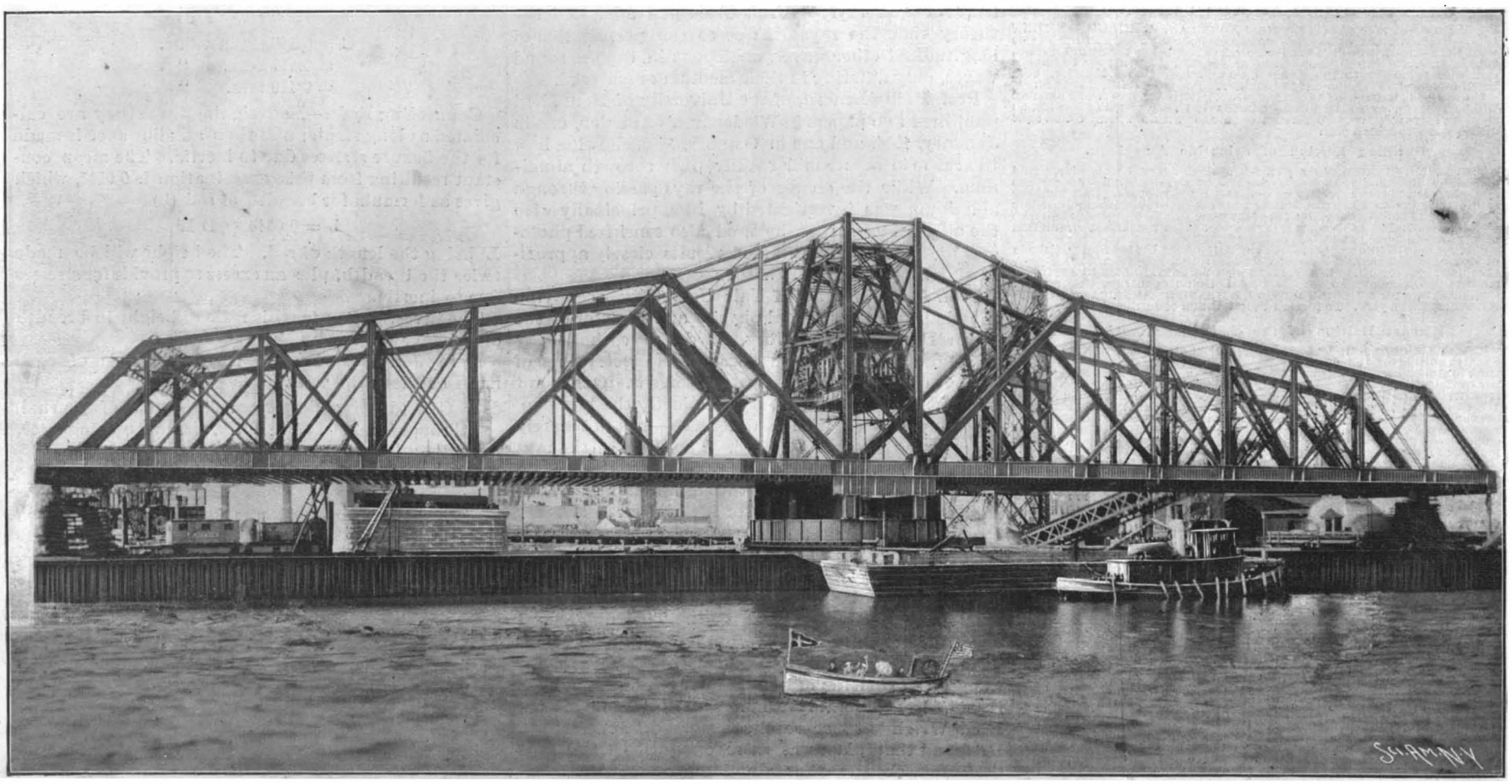
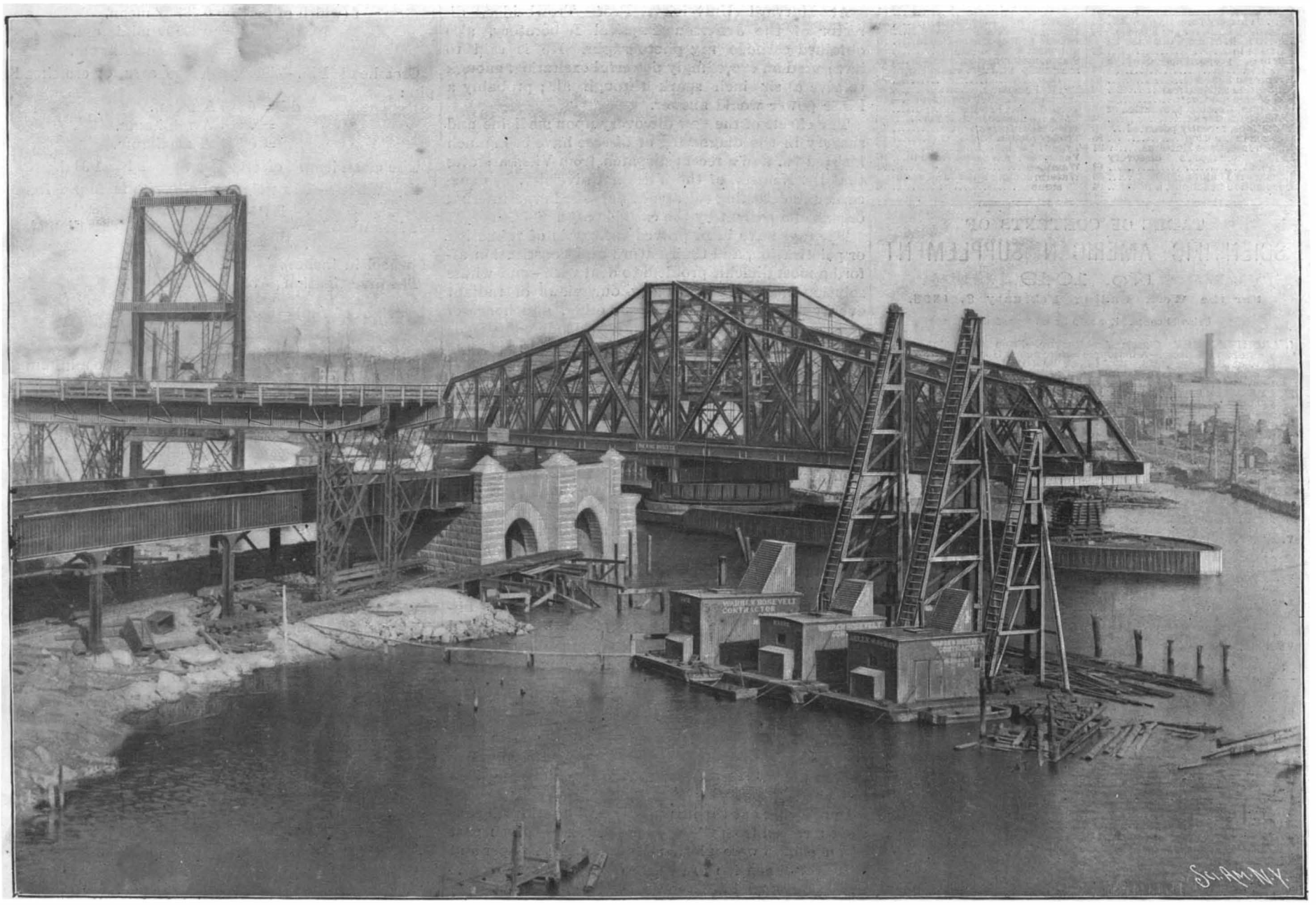


NEW FOUR TRACK RAILROAD DRAWBRIDGE FOR NEW YORK CITY.



THE DRAW SPAN OF THE FOUR TRACK HARLEM RIVER BRIDGE, STONE ABUTMENT, AND ELEVATED ROADBED.

NEW HARLEM RIVER BRIDGE AND PARK AVENUE IMPROVEMENT, NEW YORK CITY.—[See page 88.]

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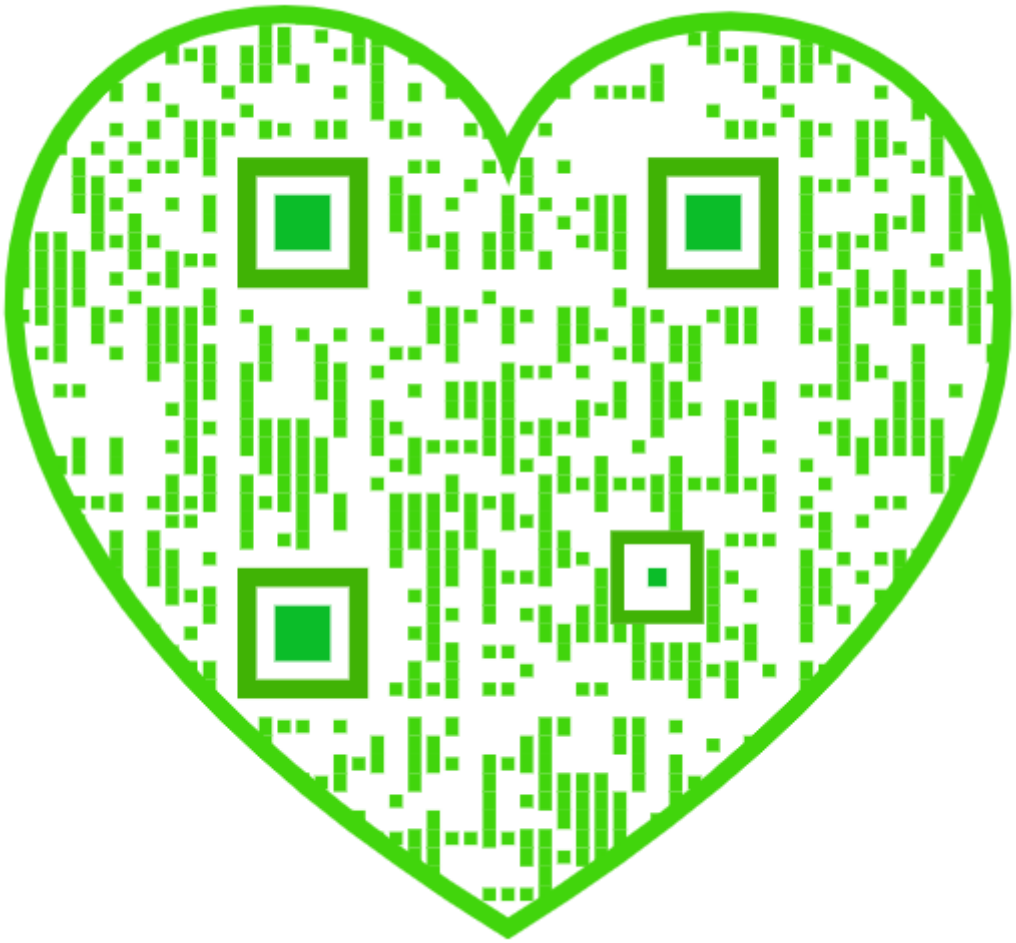

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PROF. ROENTGEN'S DISCOVERY.

The now famous Roentgen's discovery has been still further described, the accounts have assumed better shape, and his experiments have been repeated in this country by some of our leading physicists. It was on January 4, at the celebration of the semi-centennial of the founding of the Berlin Physical Society, that Prof. Roentgen described his discovery, which had been accomplished only a few days before, detailing his results and presenting proofs of his photographs. The paper covered substantially the ground gone over by us in our last issue. The rays emanating from the cathode of a Crookes tube were used, and in their new role were named "X Strahlen," or "X rays." Prof. Roentgen advanced the theory that the rays are due to the propagation of longitudinal ether waves, analogous in type to sound waves, only differing in their medium or material.

Prof. Philip Lenard, of the University of Bonn, had published two papers in Wiedemann's Annalen, one in January, 1894, and one in October, 1895, showing how the cathode rays could readily pass through aluminum. While the course of the rays passing through aluminum was investigated by him, principally with the aid of fluorescence, he used also sensitized photographic plates. He obtained results closely approximating those of Prof. Roentgen.

Prof. A. W. Wright, of Yale University, occupying the chair of experimental physics and director of the Sloan Physical Laboratory, tried the cathode ray photography with much success. He got prints of various objects through opaque screens. One point brought out is, that while it is distinctly shadow photography, it is so with a difference—it is not merely silhouettes that are imprinted. The effect of the rays upon the photographic plate varies with the nature and thickness of the object through which they pass, so that some representation of its contour and inner structure can be obtained.

One of Prof. Roentgen's exhibits was the photograph of the skeleton of a hand taken from the living hand, the point being that the bones produced a denser "shadow" than did the flesh. This differential action has enabled an aluminum medal to give an image showing its lettering and design. An attempt to take the skeleton of the hand at Yale resulted, it is said, less favorably than with Prof. Roentgen. Prof. Wright's other results were most satisfactory. He found that glass was more opaque to these rays than was ebonite, that aluminum was more transparent than other metals, and his photographs were very interesting and quite numerous.

At Harvard University, Prof. Trowbridge, director of the Jefferson Physical Laboratory, also obtained cathode ray photographs. He is said to have used an exceedingly powerful excitation, enough to give a six inch spark through air; probably a lesser power would answer.

The effects of the new discovery upon medicine and surgery in the diagnosing of disease have been much insisted on, and a recent dispatch from Vienna states that Dr. Neusser, of the Vienna University, has succeeded in detecting calcareous deposits in the internal organs of a patient by the cathode rays.

The rays have been proved incapable of refraction or polarization, and their nature and constitution afford a most difficult problem to deal with—one whose solution may greatly modify our views of radiant energy and of the luminiferous ether, and hence of cosmic questions of the utmost magnitude.

THE PROPORTIONS OF HIGH SPEED ENGINES.

At the meeting of the American Society of Mechanical Engineers held in New York during December, 1895, a valuable paper on the above subject was read by Mr. John H. Barr, of Ithaca, N. Y. The experimental work of which the paper treats, we are told, was carried out by Messrs. F. F. Gaines and H. E. Williams, as the basis of a thesis presented upon graduation at Sibley College, Cornell University.

To secure the data upon which to make the examination, a printed circular was forwarded to the principal makers of high speed engines, with the result that the available data covered about 75 engines by a dozen different builders; the sizes ranging from 25 to 225 rated horse power.

In the subjoined formulas the following notation is used:

D = diameter of piston; A = area of piston; L = length of stroke; S = steam pressure, taken at 100 pounds per square inch above exhaust, as a standard pressure; H P = rated horse power; N = revolutions per minute; C = a constant. All dimensions are given in inches.

In carrying out the investigation, the various dimensions received from the makers for any one given part of an engine were plotted on cross section paper and curves of dimension drawn. A line representing the mean and two lines representing the extremes of these observations were established. "From the equations of these lines formulas are derived which represent the average and extremes of practice." The resulting values for the constant C give the following formulas:

Crank Shaft.—d = diameter of shaft.

$$d = 7{\cdot}56 \sqrt[3]{H P \div N}$$

(the value of C ranging between 8·76 and 5·98) where 7·56 is the mean value of constant. The diagram gave a maximum of 8·76 and a minimum of 5·98 as the value of C.

Example: If a high speed engine develops 100 horse power at 250 revolutions per minute, we get by using mean value of C:

d (dia. of crankshaft) $= 7{\cdot}56 \sqrt[3]{100 \div 250} = 5{\cdot}57$ inches.

Piston Rod.—

$$d = C \sqrt[4]{D^2 L^2}$$
$$= 0{\cdot}145 \sqrt{D L}$$
$$C = 0{\cdot}145 \text{ mean value.}$$
$$= 0{\cdot}177 \text{ max. "}$$
$$= 0{\cdot}119 \text{ min. "}$$

Connecting Rods.—In designing these they are calculated as long struts; and then an allowance is made for the flexure stresses due to inertia. The mean constant resulting from this examination is 0·0545, which gives as formula for breadth of rod (b)

$$b = 0{\cdot}0545 \sqrt{D L^1}$$

L^1 being the length of rod. The height will be made twice the breadth, plus an excess to provide for stresses due to inertia.

The investigation for this ratio of height to breadth of rod gave the mean value h = 2·73b.

Main Journals.—For the projected area of each main bearing, the formula is

d l = C A (d being diameter; l, length of journal)

C ranges from 0·367 to 0·739, the mean being 0·489, then d l = 0·489 A.

Crank Pin.—Working upon the formula

$$l = C \frac{HP}{L}$$

the constant was found to vary between 0·192 and 0·417. The mean value gave the following equation:

$$l = 0{\cdot}333 \left(\frac{HP}{L}\right) + 2{\cdot}2 \text{ inches.}$$

In noting that these expressions vary in form from the fundamental formula, the author explains that "the two extreme lines of the diagram have been determined upon the proportions of only two makers." The diagram shows a wide variety of practice.

For projected area of crank pin, d l = 0·22 A.

Face of Piston.—The ratio of diameter to face of piston shows a wide variation.

$$f \text{ (width of face)} = 0{\cdot}437 D \text{ mean.}$$
$$= 0{\cdot}300 D \text{ minimum.}$$
$$= 0{\cdot}650 D \text{ maximum.}$$

Crosshead Pin.—The projected area of crosshead pin:

$$d l = 0{\cdot}105 A \text{ mean.}$$
$$= 0.066 A \text{ minimum.}$$
$$= 0{\cdot}346 A \text{ maximum.}$$

The mean length of crosshead pin is $l = 1{\cdot}33 d$.

Fly Wheel.—The weight of the rim is found from the formula $W = \frac{HP}{D_1^2 N^2}$ (in which D_1 equals diameter of wheel in inches).

The investigation gave

$$W \text{ (weight of rim)} = 833{,}000{,}000 \frac{HP}{D^2 N^2} \text{ for the mean}$$
$$= 341{,}000{,}000 \frac{HP}{D^2 N^2} \text{ for the minimum}$$
$$= 2{,}780{,}000{,}000 \frac{HP}{D^2 N^2} \text{ for the maximum}$$

The average linear velocity of the rim of wheels was found to be 4,200 feet per minute.

Weight of Reciprocating Parts.—For smoothness of running, the weight (W) should be proportional $\frac{D^2}{LN^2}$

The result obtained was $W = 1{,}850{,}000 \frac{D^2}{LN^2}$

Weight of Entire Engine per Horse Power.—The average weight of high speed engines per horse power (W) is given by formula W = 117 (HP) — 820 pounds.

The value of, and the necessity for, such an investigation as this is proved by the wide divergence shown by the various engines from the mean dimensions as ascertained. That two makers of high speed engines of the same H.P. should use two fly wheels with a difference in the weight of rim of 1 to 8 (see above) is one of those anomalies that are continually to be met with when designing is carried out on the "rule of thumb" basis.

ANTWERP is becoming a rival of London for the ivory trade of the world. A report from the British consul general at Antwerp shows the large extent to which ivory is brought to Belgium from the Congo. The ivory industry has of late sprung into new life at Antwerp.

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World's Shipping in 1895.

The annual summary of shipbuilding prepared by Lloyd's Register of British and Foreign Shipbuilding has just been issued. It shows, says the New York Sun, that the total output of the world in 1895, not including warships, was about 1,218,000 tons, 104,000 of that being about the total sail tonnage for the year. As far as has been officially recorded, the amount of sea going tonnage totally lost in the twelve months was 700,000 tons, 290,000 steam and 410,000 sail.

From these figures it can be seen that the world's sailing tonnage has been reduced 306,000 tons during the year, and the steam tonnage has increased about 824,000 tons.

Of the new tonnage launched, England has acquired 62·5 per cent. There were launched in England last year 579 vessels, a total of 950,967 tons. Of that number 526 were steam and 53 sailing vessels. In the same period fifty-nine warships were launched in England, including the output from both government and private yards. The total output for the year from British shipyards is about 95,000 tons less than for 1894, but the proportion of steam tonnage to sail has materially increased.

In 1892 sailing tonnage formed about 24 per cent of the output; in 1895 it formed about 5 per cent. These comparisons show the remarkable decline in the sailing tonnage of the world.

The summary also says that 98 per cent of the steam tonnage and 97 per cent of the sailing tonnage was built of steel. The largest steamers launched in the year were the Georgic, 10,077 tons; Victorian, 8.767 tons; and Armenian, 8,765 tons. The largest sailing vessel was the Iranian, 2,958 gross tonnage.

The table which follows shows the number of vessels, merchant and warships, and their tonnage, built in the United States and other countries outside of England. It includes every vessel above 100 tons, and is considered the most complete record ever compiled. It is as follows:

Countries.	Warships. No.	Warships. Tons dis.	Total merchant and warships built in each country. No.	Total merchant and warships built in each country. Tons.
United States	3	12,034	64	96,911
Austria-Hungary	2	11,100	12	18,471
Belgium	—	—	1	1,270
British colonies	—	—	30	10,381
Denmark	—	—	14	10,982
France	7	42,071	34	70,922
Germany	3	6,340	78	94,126
Holland	2	1,155	27	9,447
Italy	2	13,340	12	18,943
Japan	1	2,800	4	5,096
Norway	—	—	21	12,873
Russia	2	2,774	12	5,669
Spain	1	9,000	2	9,910
Sweden	—	—	13	2,767
Total	23	100,614	324	367,807

While the total output from American shipyards for the year is placed at 96,411 tons, the output from yards in the United Kingdom was about 950,000 tons. About 20 per cent of the vessels launched in England were for foreign countries, and of the vessels built 60 per cent were launched in the Greenock district. It is estimated that England sold 386,000 tons to foreign owners, and of this amount more than one-fourth went under the Japanese flag, which shows how the Japs are building up their naval and merchant marine.

The records shows that the largest vessels launched outside of England were the German bark Potosi, 4,027 tons, and the French bark Wulfrau Puget, 3,062 tons. These vessels were built under the supervision of Lloyd's Register.

Torpedo Boat Ericsson.

Secretary Herbert recently decided that he would direct the preliminary acceptance of the torpedo boat Ericsson, subject to another dock trial, the sum of $16,000 to be deducted, however, from the contract price, for failure to complete the vessel within the required time. The Ericsson is now at New London, Connecticut, and the trial will take place there. It is not unlikely that, owing to the unfortunate accidents which caused the delay in completion, Congress will authorize the remission of the $16,000.

The Ericsson has had a number of trying experiences. Accidents to her machinery caused great delay, and on her last attempt at an official trial several men were killed by an explosion and the trial was abandoned. The department is now satisfied that the machinery of the little vessel is in perfect order, and that she can make twenty-five knots an hour, which is a half knot more than required by the contract. The Ericsson was built by the Iowa Iron Works, Dubuque, Iowa.

Kilauea Volcano in Eruption.

After thirteen months of quiescence an eruption of this volcano commenced on January 3, the liquid lava rising the next day to the top of the wide shaft at the bottom of the pit and forming a burning lake 200 feet long by 150 feet wide. The upper rim of the pit is more than 450 feet higher, and the surface of the burning lake, should it reach the top, will then be much greater.

Various Mile Records.

A mile is not a thing requiring such an extraordinary time to cover, provided the coverer of it is properly equipped with a sufficiency of speed-producing powers. Below is given a partial list of some exceedingly speedy milers and their performances, and some slow but sure travelers as well:

Light—0·000005102 of a second, or 196,000 miles in one second.

Electricity—0·00000347 of a second, or 288,000 miles per second.

Earthquake—½s., as calculated by delicate instruments, or around the world in 3½ hours.

Sound in Water—1s., or 4,900 feet in one second.

Cannon Ball—1 6-10s., if it traveled at the muzzle velocity of 3,300 feet per second obtained by some guns.

Sound in Air—5s., or 1,090 feet in one second.

Birds—18s. It is said the frigate bird flies 200 miles an hour; a mile in 24s. by the kestril, or sparrow-hawk, which is said to fly 150 miles an hour; in 1m. 9s. by a pigeon, when flying 200 miles in an actual race; in 1m. 15½s. by a pigeon when flying 400 miles in an actual race.

Railway Train—32s., in May, 1893, the Empire State Express, of the New York Central and Hudson River Road, drawn by engine "999," with Engineer Hogan, near Crittenden, N. Y., or a rate of 112½ miles in an hour.

Duck—40s. or 90 miles an hour.

Electric Railway—59s., on the Baltimore and Ohio Railway, at the Baltimore Tunnel in September, 1895.

Ice Boat—1m., at Newburg Bay, Hudson River.

Tandem Bicycle on Straightaway Road—1m. 17 1-5s., on December 16, 1895, on a straightaway road built for the purpose at Cheynne, Wyo., with a wind blowing 30 miles an hour, by two riders, John Green and Charles S. Erswell.

Bicycle Straightaway—1m. 25s., John Green, Cheyenne.

Horse Running—1m. 35⅕s., by Salvator, at Monmouth Park, August 28, 1890.

Bicycle on Track—1m. 40 3-5s., by P. J. Berlo, New Orleans.

Dog.—1m. 43 1-5s., if the greyhound coursed one mile, the usual distance of 200 yards having been run in 11¼s.

Boat—1m. 45s., torpedo boat Sokol, made by Messrs. Yarrow, of England, for Russia, and which developed in October, 1895, a speed of 34 miles an hour. Steamship Lucania in 2m. 13 4-5s.

Bicycle Quadruplet—1m. 47 4-5s., on October 17, 1895, at Denver, Col., unpaced, flying start, Connibear, Dickson, Stone, and Swanbrough.

Bicycle Tandem on Track—1m. 52¾s., on October 27, 1894, at Waltham, Mass., flying start, paced, Haggerty and Williams; on August 17, 1894, at Denver, Col., flying start, unpaced, Titus and Cabanne, in 1m. 55¾s.

Horse Pacing—2m. 1½s., by Robert J., at Terre Haute, Ind., on September 14, 1894, against time.

Bicycle Triplet—2m. 1 4 5s., unpaced, standing start, Kennedy, Murphy and Saunders.

Horse Trotting—2m. 3¾s., by Alix, at Galesburg, Ill., September 13, 1894.

Horse Team Trotting—2m. 12¼s., by Belle Hamlin and Honest George, driven by E. F. Geers, at Providence, R. I., September 23, 1892.

Man Skating—2m. 12 3-5s., by J. F. Donoghue.

Horse Under Saddle—2m. 13s., by Johnson, pacing at Cleveland, O., August 3, 1883, against time; in 2m. 15¾s., by Great Eastern, trotting at Fleetwood Park, September 22, 1877.

Crow—2m. 40s., or 25 miles an hour.

Horseless Carriage—4m., a carriage running 750 miles, from Paris to Bordeaux, in the international race of 1895, or 15 miles an hour throughout.

Man Running—4m. 12¾s., professional, W. G. George; in 4m. 17 4-5s., amateur, T. P. Conneff.

Man Rowing—5m. 1s., by Ellis Ward, on the Savannah River, Florida, April 1, 1872.

Man Walking—6m. 23s., professional, W. Perkins, of England; in 6m. 29 3-5s., amateur, F. P. Murray, of the United States.

Canoe—6m. 40s., July, 1894, by C. E. Archibald, at the fifteenth annual meet of the A. C. A., held at Croton Point, L. I.

Man Swimming—27m. 21 2-5s., J. H. Tyers, Englishman; in 28m. 55 2-5s., G. Whitaker, American; both amateurs; both with seven turns.

Man in Tub—1h. 10m., by Gus Frates, in Oregon, in 1895, paddling in a tub 6 miles in 7 hours.

As will be seen by a study of the above list, in the case where figures are given of speed production wherein man is a factor, the bicycle is beaten only by the railway train, the electric railway, and the ice boat, and its nearest competitor is the running horse, and he is 18 seconds slower. Relatively, it seems as though it were impossible for the bicycle to attain a higher position in the speed world, 17½ seconds separating it from its nearest leader, the ice boat, a lead which looks almost impossible to overcome, if the idea is accepted that anything in the speed line is a cycling impossibility.—The Wheel.

Photography and Chronographic Measurements.

The British Journal of Photography says:

"A note on this subject, from a lecture by Mr. Frederick J. Smith, appears in a recent number of Nature. In order to avoid the error of 'time-lag,' introduced by the use of magnetic and solenoidal arrangements, he has devised a method based entirely on the use of light. Two sources of light at a suitable distance apart throw two beams of light on to a sensitive plate, carried in the carriage of a tram chronograph. By means of lenses the beams of light are caused to form two sharp images on the plate in a vertical line, one above the other, a tuning fork trace is also made on the plate; if the plate traverses when the beams of light are not interrupted, on development two black parallel lines appear on the plate; but if during the passage of the plate the beams of light are cut by any solid object which shuts off the light, then, on development, two gaps are seen to exist. The distance between these markings, when interpreted in terms of the fork trace, gives the velocity of the object which cuts through the beam of light.

"In another method, the projectile cut during its flight through two thin screens, placed in the paths of the beams, and so opened a passage for the light. Two parallel lines are then formed on the plate, one longer than the other; the difference in their lengths duly interpreted gives the velocity of the projectile. This new mode of registering velocities would seem to be very valuable, as the most exact determination of the rapidity of the flight of projectiles at various stages is of great importance in artillery investigations."

Diminution of Risks with Electric Lighting.

The following suggestions are offered by the American National Board of Fire Underwriters to people who are about to employ electric lighting:

1. Have your wiring done by responsible parties, and make contract subject to underwriters' rules. Cheap work and dangerous work usually go hand in hand.

2. Switch bases and cut-out blocks should be noncombustible (procelain or glass).

3. Incandescent lamps get hot; therefore all inflammable material should be kept away from them. Many fires have been caused by inflammable goods being placed in contact with incandescent lamp globes and sockets.

4. The use of flexible cord should be restricted to straight pendent drops and should not be used in show windows.

5. Wires should be supported on glass or porcelain, and never on wooded cleats; or else run in approved conduits.

6. Wires should not approach each other nearer than 8 inches in arc and 2½ inches in incandescent lighting.

7. Wires should not come into contact with metal pipes.

8. Metal staples to fasten wires should not be used.

9. Wires should not come into contact with other substances than their designed insulating supports.

10. All joints and splices should be thoroughly soldered and carefully wrapped with tape.

11. Wires should always be protected with tubes of glass or porcelain where passing through walls, partitions, timbers, etc. Soft rubber tube is especially dangerous.

12. All combination fixtures, such as gas fixtures and electric lamps attached, should have approved insulating joints. The use of soft rubber or any material in such joints that will shrink or crack by variation of temperature is dangerous.

13. Electric gas lighting and electric lights on the same fixture always increase the hazard of fire and should accordingly be avoided.

14. An electric arc light gives off sparks and embers. All arc lamps in vicinity of inflammable material should have wire nets surrounding the globe, and such spark arresters reaching from globe to body of lamp as will prevent the escape of sparks, melted copper and particles of carbon.

15. Arc light wires should never be concealed.

16. Current from street railway wires should never be used for lighting or power in any building, as it is extremely dangerous.

17. When possible, the current should be shut off by a switch where the wires enter the building when the lights or power are not in use.

18. Remember that "resistance boxes," "regulators," "controllers, "rheostats," "reducers" and all such things are sources of heat and should be treated like stoves. Any resistance introduced in an electric circuit transforms electric energy into heat. Electric heaters are constructed on this principle. Do not use wooden cases for these stoves, nor mount them on woodwork.

Locomotive Building, 1895.

All of the thirteen locomotive building companies in the United States, except one, says the Railroad Gazette, turned out more locomotives in the past than in the previous year, the total number having been 1,109, as against 695 in 1894. The freight cars built in 1895 were 31,803, as compared with 17,029 in 1894.

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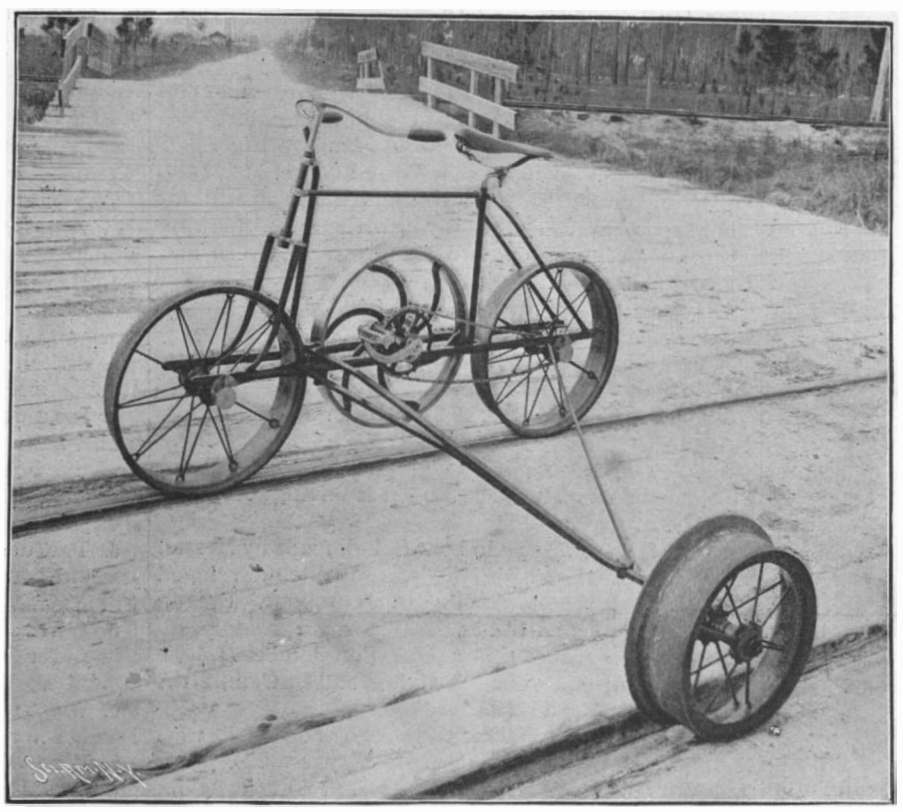
AN IMPROVED PROPELLING MECHANISM.

The accompanying illustrations represent improved means for the propulsion of bicycles, railway velocipedes, and hand cars, showing also the position and appearance of the mechanism when adapted to the bicycle and velocipede car. The improvement forms the subject of a patent recently issued to James J. Thompson, of Jacksonville, Fla., of which the object is to increase the power of propulsion of either class of cars or bicycle, by utilizing power generated through the instrumentality of a flywheel, and at the same time proportionately lessen the muscular exertion on the part of the operator. The sectional view represents the mechanism and its working, the device being attached to the frame bar for use on either style of car, or to the tubular frame of the bicycle. The hubs of the cranks, secured to the crank shaft, are journaled in ball bearings adjustable in hangers, and a large gear secured to the crank shaft meshes with the smaller gear of a compound gear revolving on ball bearings. The larger of the compound gears meshes with a small gear on the hub of the flywheel, revolving freely on ball bearings on the crank shaft. A sprocket wheel on the crank shaft connects in the usual way by an endless chain with a sprocket on the driven wheel.

By rotating the crank shaft, as in driving the ordinary bicycle, the gears are made to also revolve the flywheel, and power is thus accumulated. For hand cars, motion is obtained by the use of the ordinary lever and rods connecting it with the cranks, which, by their simultaneous action, convert the reciprocal motion of the lever into the rotary motion of the cranks. The flywheel is made to revolve many times oftener than the crank shaft through the medium of the compound gears, and, when once the power is properly adjusted, it is a simple matter to gear the speed of the bicycle to any pitch desired, and of either class of cars sufficiently to maintain the same upon the track with safety. At no period in the revolution of the cranks is there a diminution of power applied to the crank shaft through the lack of leverage force, as the increased momentum gained in the flywheel develops power sufficient to eliminate the effects of lost motion and drives the cranks on over dead centers, thus perpetuating the constant speed or progress of the car or bicycle, that would otherwise be retarded by sacrificing a sufficient amount of the speed power in rotating the cranks to the initial point of leverage.

Velocipede and hand cars equipped with this mechanism are also provided with patent roller bearing axle boxes, in the chamber of which the wheel axle of the car is made to revolve freely without friction. One of our views is a reproduction from a photograph taken of a velocipede car upon the track in actual service equipped with this mechanism, and another is a side view representing the mechanism in place on a bicycle.

BICYCLE WITH THOMPSON'S PROPELLING MECHANISM.



RAILWAY VELOCIPEDE WITH THOMPSON'S PROPELLING MECHANISM.

A Novel Headlight.

An Englishman has invented an automatic headlight. In going around curves headlights on locomotives, being stationary, throw the light straight ahead, instead of throwing it so that it covers the track, where, of course, the light should be all the time. The automatic headlight is suspended on two pivots, one on top and one on the bottom, so that it can swing freely. From the bottom of the headlight two chains run to the ends of an arm which is connected by a rod that runs to the pilot wheels' truck. When the pilot wheels strike a curve, the outside wheel forges slightly ahead, and this moves the rod and chain enough to move the headlight so that the reflection is cast directly ahead on the track. Out of the total of 1,650 railroad accidents in 1895, about 875 were due to derailments, usually on curves. There is no doubt that a certain percentage of these accidents could have been avoided by the use of an automatic headlight.

THE STRANDING OF THE STEAMSHIP ST. PAUL OF THE AMERICAN LINE.

The news of the stranding of the steamship St. Paul, the newest representative of the American Line, has been made known far and wide through the columns of the daily press. Starting from Southampton, England, on January 15, for America, the ship was making a fast passage across. When partly across, the Campania, of the Cunard Line, appeared on the scene, and for many hours the two ships were in company with each other. The claim made for the St. Paul and for her sister ship, the St. Louis, is that they are remarkably fast in a seaway, it being generally conceded that the larger Campania is faster in smooth water. For some reason both ships got far south of their reckoning, and approaching the American coast in a dense fog, headed straight for the New Jersey coast at Long Branch, fifteen or twenty miles south of their proper position. The lead was kept going on both ships, but in spite of the frequent soundings, the St. Paul, at 1:47 A. M., January 25, ran aground on the beach at Long Branch, near the Iron Pier, while the Campania, some three miles to the south, barely escaped a like fate.

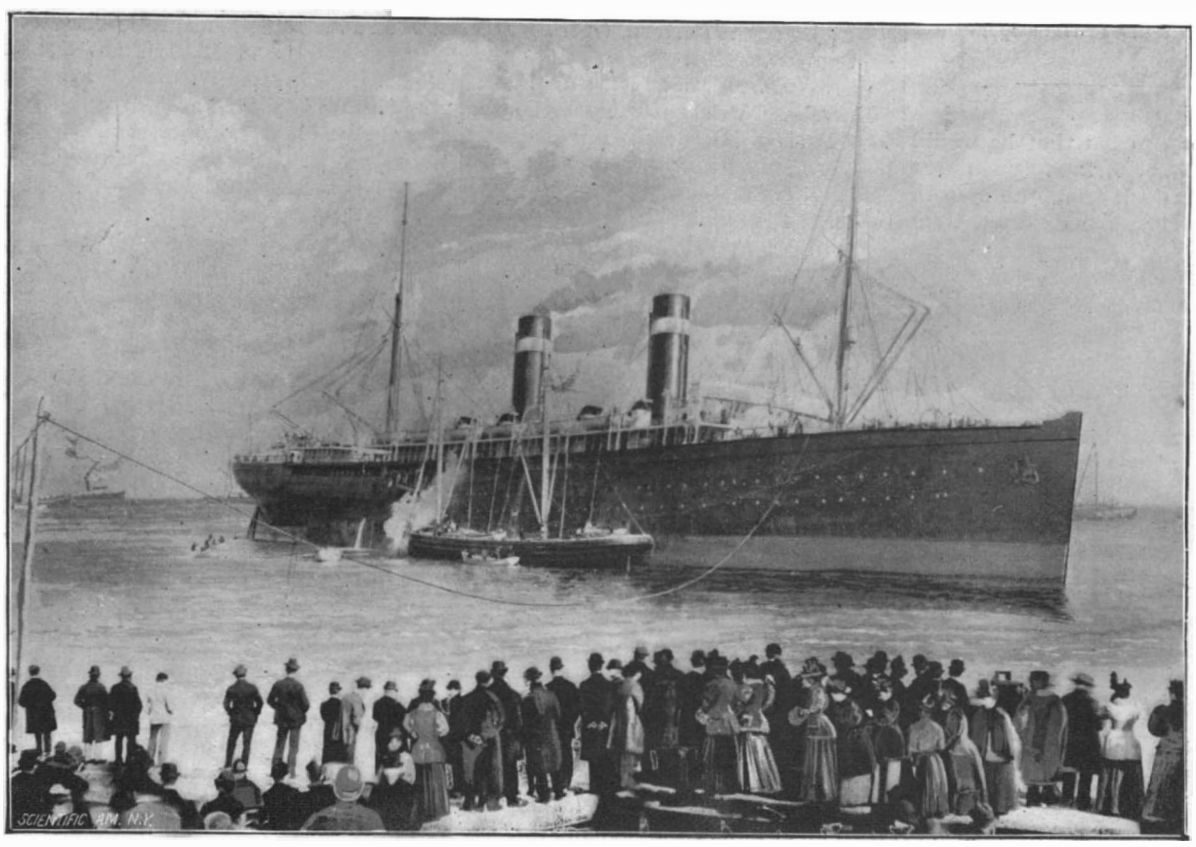
The wreckers were at once notified of the disaster and have made strenuous efforts to pull the ship off, but the want of sufficiently high tide has militated against their efforts.

We present our readers with a view of the stranded ship as she lay almost broadside on to the beach. Long Branch is one of the great summer resorts of New Yorkers and is within easy reach of the city. The trains running there have done a heavy business in the transportation to Long Branch of people desirous of seeing the stranded vessel. Thousands have gone there, and the place, ordinarily deserted at this season, has presented a scene of life and animation very foreign to the seashore in the month of January.

A telephone station was established on the ship, so as to keep her in constant communication with the outer world. As she lay on the beach, the wire of the telephone line, running from a pole on shore to the ship rail, has been her only connection with the land. It seemed a curious illustration of fin-de-siécle advancement, the establishment of a telephone station on a wrecked ship. There was no loss of life or property. The ship struck so gently that the passengers were not awakened.

We have already fully described and illustrated the St. Paul. She appeared to be on her way to making some fine transatlantic records and may do so in the coming season. She is fitted throughout with the most elaborate improvements for comfort and safety. Her staterooms in their arrangement and size are a distinct advance on those of other ships. One excellent feature is the arrangement of rooms opening into each other, so that friends or members of the same party occupying rooms opening on adjoining corridors can open the door between them and have thorough ventilation all day.

Our illustrations show some of the most interesting features of a cabin on the St. Paul and St. Louis, the most novel being the air mattresses. If there is any place where a person requires every appliance for comfort it is in a ship's stateroom, and in supplying their new vessels with air mattresses the American Line has made a distinct advance over the old time practices. The air mattress presents the features of being always in condition, never wearing into hills and



THE STEAMSHIP ST. PAUL STRANDED OFF LONG BRANCH.

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hollows; it is always cool and is the most cleanly type of bed that has ever been devised. All these qualities go to make it the acme of luxury in the sleeping way. By inflating to different degrees of softness any one's "personal coefficient" is met.

The mattress consists of a sack of air-tight rubber cloth with the back and front stayed together in a number of places corresponding to the tufting of ordinary mattresses. The outer covering is of strong cotton duck heavily coated with rubber and vulcanized. To inflate it a foot bellows is supplied. Our cut shows the operation of inflating as in progress in one of the American Line staterooms. The bellows is connected to the valve of the mattress by a long India rubber tube; a few strokes of the bellows inflates it, the tube is removed, the valve screwed down, and the mattress is ready for use. It may not need another pumping for a year or more. Sometimes a mattress is pumped up hard, and the occupant lying on it has the air withdrawn until the exact pressure to suit his or her ideas is reached.

For marine use the mattresses are fitted with life lines, a single mattress being a life preserver, capable of sustaining as many people as can find room to grasp the lines. The same company supplies a neck collar, which is simply sprung around the neck, and which makes drowning an impossibility for the wearer. This collar goes on without any tying, its elasticity holding it in place.

One of our cuts shows this collar, and next to it mattresses designed for camp use, one with and one without a pillow attached. Other cuts show double mattresses and pillows, hassocks, chair seats, and cushions, and give an idea only of the variety of goods of this kind supplied by the Mechanical Manufacturing Company. Their address is 146 Franklin Street, Boston, Mass. One of their recent achievements is the providing of an entire church with air pew cushions, making devotion in the old Puritan town more luxurious than would ever have accorded with the ideas of the Pilgrim fathers.

One important feature about air mattresses is that they do not require making over. With hair mattresses this is a periodical necessity. For household use this feature is of value, and on ships using them by the hundred the stateroom stewards are saved much work by being exempted from the necessity of working over and beating into condition mattresses which get worn down and out of shape.

Trolley Road in Rome.

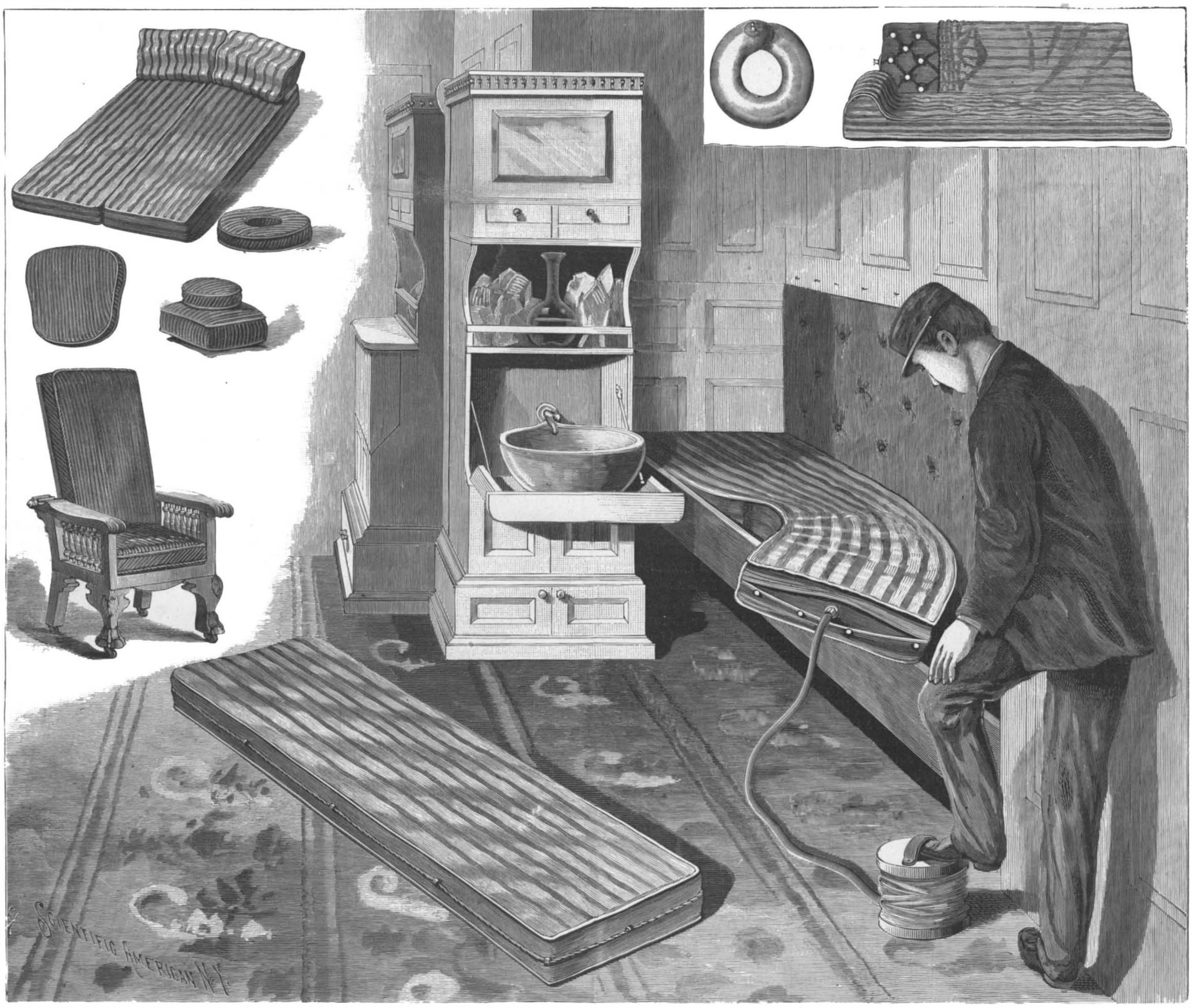
The new electric tramway which connects the main railway station of Rome with the center of the city is proving a great success as a means of rapid communication between the high and the low parts of the city, although it has had many difficulties to contend with.

The local authorities wisely refused to allow their principal streets to be desecrated by the poles and wires of an overhead system of traction; so the route chosen was very difficult, on account of the steep gradients encountered in several places, as well as some very sharp corners. It starts from the Piazza S. Silvestro and goes up the Via di Capo le Case and then through the Ludovisian Quarter to the Piazza di Termini. It consists of a double track nearly two miles long, and the general arrangements are the same as on the Havre tramways. Where telegraph and telephone wires cross the tramway, guard wires of steel are suspended to stop their fall and prevent them touching the trolley wire, if by any chance they broke. They are certainly not beautiful, but they are essential to the public safety. The trolley wire is supported by double bracket standards; where the track makes sharp bends cables attached to the walls are necessary to pull it out into the required curve, the wire coinciding really with the sides of the inscribed polygon. In some places the incline is over eight per cent, so special brakes are necessary. Both hand and foot brakes are used, one acting on the wheels directly and the other on the rails.

In addition there is an electric emergency brake, which will stop the car in a few yards, even when going quickly down hill. The principle of it consists in short-circuiting the motors, which are then driven as dynamos by the momentum of the car, which is thus rapidly stopped. The cars weigh seven tons when empty, and when loaded their carrying capacity is stated as forty; but there are often more than fifty passengers on them. Their weight is about ten tons. They start every five minutes and take thirteen or fourteen minutes to perform the whole journey, the maximum speed allowed being nine miles an hour. The cars are well lit, and an elaborate system of electric bells enables each passenger from his seat to communicate with the motorman.

The motors are worked by current brought from the Electric Lighting Company, who possess the famous Tivoli-Rome transmission plant. At Tivoli, on the slope of the Sabine Hills, the power developed in large turbines is converted into electric energy by alternators, and is conveyed at high pressure by four cables across the Campagna, a distance of eighteen miles, to a transformer house just outside the Porta Pia, where the pressure is reduced before it is distributed to various subcenters in the city. As the current is alternating, it is transformed into continuous by means of high speed dynamo motors. It is then used to charge accumulators and give a constant 550 volt supply to the trolley wire.

The General Electric Company, of the United States, did the overhead work and the equipment of the cars. —The Builder, London.



THE CABIN OF THE ST. PAUL—PERFECTION AIR MATTRESSES AND LIFE PRESERVERS.

EVERGREEN privet (Ligustrum ovalifolium) thrives in most climates. This is one of the plants so useful for making a rapid growing hedge, and for cover for game, as well as for ornament in the mixed shrubbery as bush plants. It has all but completely shut out the ordinary deciduous small-leaved forms, and to a certain extent, adds the Garden, the oblong evergreen forms. In some localities it loses its leaves only partially during winter. In ordinary winters it remains evergreen in most localities.

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Science Notes.

Tea-Leaf Smoking.—According to Cassell's Saturday Magazine, it has become a fashionable distraction in England to smoke green tea in the form of cigarettes. A large number of the adepts of this new pastime, says the English journal, are highly educated women. A physician who has had occasion to treat patients for extreme nervousness and insomnia due to this practice states that among them there is a well known female writer whose novels are widely read and who habitually smokes from twenty to thirty tea cigarettes while working.

"At the home of a well known lady whom I am attending," says he, "tea cigarettes are always passed around after dinner, and I know three celebrated actresses who give tea smoking parties twice a week. A number of literary ladies at Kensington have formed a small club for the same purpose. One of my patients spends nearly two pounds a week to satisfy her mania. This habit, moreover, is spreading to such an extent that certain tobacco dealers are now offering packages of tea cigarettes to the public."

Psychophotography.—That real images of objects are formed upon the human retina and persist temporarily seems to be proved by a series of experiments made by Mr. W. Ingles Rogers and described by him in the Amateur Photographer for November 22, 1895. Mr. Rogers took a shilling and looked at it intently in ordinary daylight for fully a minute, with the idea of fixing the image of it distinctly upon the retina. He then drew a yellow screen over the window of the room in which he sat, so as to exclude all actinic light, and, placing a photographic plate in a certain position, fixed his eyes upon the center of it, at the same time allowing nothing but the image of the coin to occupy his mind. He remained looking at the plate for forty-three minutes and afterward developed it, with the result that an outline of the coin was clearly shown upon it. The second experiment, made in the presence of three trustworthy witnesses whose testimony accompanies Mr. Rogers' communication, was still more remarkable in its result. In this case a postage stamp was substituted for the shilling. This was gazed at in a strong light for one minute. It was then removed and a plate put in its place and looked at for twenty minutes. The resulting "psychogram," which is reproduced in the Amateur Photographer, lacked detail, but sufficient was shown to prove that the picture of an object impressed upon the retina can send out vibrations that will result in the production of an image upon a sensitized plate.

The Power of Guns.—One might be accused of romancing were he to assert that a gun is of several million horse power, and yet nothing is more exact, as we shall demonstrate. The Italian 100 ton gun (model of 1879), with a 550 pound charge of powder, throws a projectile weighing 2,020 pounds at an initial velocity of 1,715 feet per second. It communicates to it, therefore, a live power or kinetic force of 92,597,000 foot pounds. The thrust exerted by the gases due to the ignition of the powder lasts less than a hundredth of a second. The result is that during the active period of the work of the powder in the gun, the mean power is greater than 87 million foot pounds per hundredth of a second, say 8,700 million foot pounds per second. This represents a power of 12 million kilowatts or 17 million horse power.

There is unfortunately another side to this picture. Although large guns are extraordinarily powerful, their active life is essentially ephemeral, since, after a hundred shots, they are generally out of service. They have then worked actively one second!

The same calculation applied to modern guns that throw 2,200 pound projectiles, and communicate thereto an initial velocity of 1,970 feet a second, demonstrates, further, that such guns, during less than a hundredth of a second each time, develop a formidable power of 13,050,000,000 foot pounds per second, say 24,000,000 horse power.

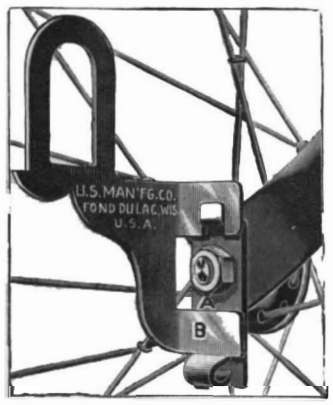
Taking Impressions of Plants.—The following simple method of taking impressions of plants is due to Mr. Bertot, of the French Academy of Sciences. A sheet of paper is first lightly oiled on one side, and then folded in four, so that the oil may filter through the pores, and the plant may not come into direct contact with the liquid. The plant is placed between the leaves of the second folding, and in this position is pressed, through other paper, all over with the hand, so as to cause a small quantity of oil to adhere to the surface. Then it is taken out and placed carefully upon white paper, another sheet is placed above (as two impressions can be taken out at once) and the plant is pressed as before. Upon now removing it, an invisible image remains on the paper. Over this is sprinkled powdered black lead, which causes the image to appear. With an assortment of pigments, the natural colors of plants may be reproduced. To obtain fixity, resin is mixed with the color in small quantity. The impression becomes fixed when it is exposed to a heat sufficient to melt the resin.

Prevention of the Freezing of Gas Pipes.—It has been thought up to the present that the freezing of gas pipes in winter is due solely to the aqueous vapor carried along, and which, under the influence of the cold, is first condensed and then congealed, so as to obstruct the pipes. An attempt has been made to overcome this inconvenience by drying the gas through the action of concentrated sulphuric acid. But during the course of last winter it was found that, despite such precaution, there occurred numerous cases of freezing that had to be attributed to the congelation of the benzole. It, therefore, became necessary to seek another process which should prove efficacious in both cases at once. A process of this kind, recently patented by the Deutsche Continental Gas Gesellschaft, of Dessau, consists in injecting into the gas upon its exit from the gasometer a determinate quantity of vapor of alcohol. If, under the action of cold, the aqueous vapor and benzol condense, it will be the same with the alcohol, the introduction of which into the mixture will lower the point of congelation, and hence prevent the obstruction of the conduits.

The experiments made last winter demonstrated that the influence of the alcoholic vapor makes itself felt at a distance of two and a half miles from the gasometer. On the contrary, it disappears as soon as the gas passes through a wet meter. So the inventors advise the installation of a small injector alongside of the meter in factories, railway stations, etc., in order to permit of adding alcoholic vapor anew to the gas. The proportion of alcohol necessary is 5 grammes of impure 95° alcohol to the cubic meter of gas. In extremely cold weather the proportion of alcohol may be raised to 6 or 7 grammes. The addition of this small quantity of alcohol has no influence upon the calorific or illuminating power of the gas.

AN IMPROVED BICYCLE LAMP BRACKET.

The illustration represents a simple and durable lamp bracket patented by James E. Bean, readily attached to and removed from a bicycle without disconnecting the lamp and the bracket. The improvement is being introduced by United States Manufacturing Company, Fond du Lac, Wis. In the illustration, B represents the bracket, which is held in place by a strong spring catch at its lower end, but may be readily removed, leaving only the small clip, A, attached under the axle nut. The catch is very strong, and may be made as tight as the user desires, so that it will never shake off or get loose.



THE UNITED STATES DETACHABLE LAMP BRACKET.

Treasure Houses in New York.

"If the New York dry goods district should be destroyed to-night," said a business man to a representative of the Sun, "every great insurance company in the world would fail." Doubtless there is some exaggeration in such an opinion, but there are $900,000,000 worth of insurable goods in the comparatively small down-town area known as the dry goods district, to say nothing of buildings, furniture, and fixtures. London and perhaps Paris are the only other cities in the world that equal New York as treasure houses of manufactured goods.

A single wholesale and retail house in the fashionable shopping district of Broadway contains $11,000,000 worth of goods. Another house in Twenty-third Street contains $6,000,000 worth. There must be scores of business houses containing from $1,000,000 to $5,000,000 worth of goods. The goods stored in three or four business districts would more than pay the national debt. The goods in the great clothing district run up into the hundreds of millions. The little jewelry district down-town is one of the richest urban areas in the world. Silverware, gold, and jewels valued at hundreds of millions are stored in the district centered about Union Square. The samples of a single hat house brought at auction in a recent year $70,000. Some of the most precious articles in proportion to bulk are stored in the drug and chemical and perfumery houses in the region south of Fulton Street and east of William. The book publishing district, now stringing itself along from Astor Place to Twenty-fifth Street, is stocked with many million dollars' worth of books. Single buildings with their contents and the land they occupy are worth more than the assessed value of many a rural county in this State.

New York Section of the American Chemical Society.

The regular monthly meeting of the Chemical Society will be held on Friday, February 7, at 8:30 P. M., in the chemical lecture room of the College of the City of New York. The usual informal dinner will precede the meeting and will be at the Hotel Bartholdi, Broadway and Twenty-third Street, at 6:30 o'clock.

American Trade in Venezuela.

If any appreciable increase in the imports from the United States into Venezuela is perceptible, it is simply due to recent and better facilities for the distribution of merchandise, and is confined to such articles as heretofore imported—flour, lard, hams, kerosene, "blended" butter, lumber, some kinds of hardware, common glassware, etc.; but the essential feature of our trade—the general introduction of our manufactured goods—is still wanting.

The stereotyped complaints about the independence of our manufacturers at first impels the belief that they do not want this Latin-American trade, but I am beginning no doubt the sincerity and validity of this criticism, invariably advanced by foreign merchants having their chief houses in Europe, and controlling nearly all branches of trade. If my suspicions are well founded, these statements are made to deceive the small native merchant and compel the purchase of such goods as it may be to the interest of the foreigner to further, which almost invariably means European. His present control of the market enables him to dictate both the place whence and the kind of goods he will import and sell, without regard to native taste, which, thus far, he has cultivated in one direction. Until some purely American houses are established in Venezuela, aided by a friendly native sympathy and sentiment, we cannot hope to make great inroads in the sale of manufactured goods.

An important item of importation is fine table butter, which is now almost wholly supplied by Denmark, and costs, delivered at Hamburg, about 30 cents, put up in tin cans of one-half pound and upward, hermetically sealed. I am convinced if some dairy near New York were to make an effort to secure part of this trade, it would prove successful and profitable. American butter as at present packed—with no view to its preservation in this climate—is justly in bad odor. To obtain the trade of an article of such universal consumption, is at least a good subject for investigation.

Until within three or four years, comparatively little cutlery was imported from the United States. Since then some improvement is visible, and it is within the power of our manufacturers to increase their sales in this line.

The largest native dealer in cutlery and hardware showed me through his warehouse, explaining the needs of the trade and wherein Germans, English, and Americans excelled, and expressed an earnest desire to make closer connections with American manufacturers, and his willingness to send them samples of various goods, believing that when once thoroughly acquainted with Venezuelan trade our people could obtain a greater share than they have at present secured. This opinion I fully share.

In brief, we have made a beginning in the sale of knives, forks, hatchets, axes, hammers, and files (the latter preferred to all others), while crowbars, shovels, spades, hoes, scissors, etc., are almost exclusively purchased in England and Germany, in addition to everything bought in the United States.

The machete, of which tens of thousands are sold annually, are all bought in England. The machete is simply a very large and broad knife, slightly varying in size, but usually about 18 to 22 inches long and 2 to 3 inches broad, with which the Latin-American cannot dispense, and which he applies to more uses than one can conceive.

VENEZUELAN MANUFACTURES.

Venezuela is solely an agricultural country. Its factories are few, often of the crudest kind and devoted to the manufacture of the most pressing native wants, such as sole leather, soap, candles, matches, cigarettes, rum, native shoes (alpargatas), hats, and sugar.

The manufacture of sole leather seems to have acquired an impetus and support, for which its large consumption and the high duty thereon seems responsible. Puerto Cabello supports two tanneries, one electric, the other employing the usual improved methods. The output of the latter is about 27,800 pounds per week, with the prospect of the plant being enlarged and the output increased. French and English machinery is employed. I am not aware of any tannery in the country manufacturing uppers. As Venezuela exports large quantities of goat and deer skins and hides, suitable for uppers, the suggestion is made that it might prove profitable if some large tannery in the United States would establish a branch in this country for this purpose, with American machinery and conducted on American principles. The duty on manufactured leather being $4 per kilogramme (2·2 pounds), and on the unmanufactured 50 cents per kilogramme, the poor people are practically debarred from its general use, and confine themselves, for ordinary wear, to the native alpargata, a modified scriptural sandal composed of a solid piece of sole leather, shaped for the foot, with a woven cotton upper, having an outlet for the big toe, a piece of similar material secured to the leather heel, and then passed over and fastened to the upper part of the heel of the foot.

The importation of sugar being prohibited, all large cane plantations have their sugar mills, with more or less advanced processes for placing the product on the

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market, but no refinery exists in Venezuela, and all sugar sold ranges from a very dark to a light brown.

Soap is made from native cocoanut oil, and candles from stearin imported from Europe. Both industries are not only among the most profitable, but also of the greatest magnitude in Venezuela, the high duty giving them a monopoly in the common grade of these articles. Fancy and fine perfumed soap is not manufactured.

Rum and cigarettes are made from native products. Tobacco of excellent quality is grown and employed in the manufacture of the latter, together with considerable Cuban tobacco. Both industries seem to have reached a profitable base.

The alpargata (shoe) is manufactured, or rather put together, by numerous small factories, the woven cotton being usually purchased from the large factory in Valencia which makes a specialty of this article.

TARIFF.

The tariff of the country is divided into nine classes. Duty is charged on the gross weight. A package of merchandise containing any article belonging to a higher class pays duty on the whole as of that class.

BANKING FACILITIES.

The want of banking facilities is often keenly felt. The two banks of Caracas and that of Maracaibo are the only institutions of the kind in the country, and with agencies limited as to the places and transactions, have, under prudent management, proved very profitable and beneficial to the business interests of the country. The want of such institutions in agricultural districts is generally recognized and deplored, and I can suggest no more profitable undertaking than one of this character, based on large capital and commercial standing. Large planters often require ready money to carry on their operations, and are compelled to resort either to the large merchant or usurer. In either case, he pays a rate of interest seldom less than 12 per cent, and not unusually 18 per cent per annum. If he deals with the former, he may be expected to purchase his supplies from him, paying a large profit on the sale. The planter's paper and collateral are unquestioned.

Often strangers with the best bills of credit find themselves remote from these legitimate institutions and are forced to submit to such a rate of exchange as the merchant may exact.

Attempts have, at various times, been made to obtain banking concessions, but always accompanied with such conditions as to make their denial necessary and imperative.

American capital invested in banks would be as safe and secure as at home. An American bank and American business houses are the only factors that will loosen the grip of European exporters.

FINANCE AND CURRENCY.

All values in this country are based on gold—gold of all nations being current as a commodity. Silver of other countries is forbidden circulation, but that of Venezuela is on a parity with its gold and is accepted in payment of all dues, public and private, without loss. This is due to the fact that, at present, no silver is coined and never has been, in excess of the government's ability to redeem it in gold. It is generally understood that were this limit of ability passed, the same conditions would exist here that prevail in all other South American republics, namely, silver would be at a large discount, and the poorer classes would suffer in the payment of their dues. Venezuela is, therefore, proud of the standing its silver coin has among the nations of the world.

The last Congress prohibited the emission of paper money by the government. The paper money in circulation is that of the banks at Caracas and Maracaibo, the only institutions authorized to issue paper money. For this money the government is in no wise responsible its acceptance not being compulsory, and it circulates only on the credit and integrity of the banks and in their own vicinity. Its issue is very limited.

INLAND TRANSPORTATION.

Until some few years ago, Venezuela was without a railroad. Now, not only are the ports of La Guayra and Puerto Cabello connected with Caracas by rail, but Barquisimeto and other places with the coast in like manner, while many railroad "concessions" for the development of the remote interior seem to have acquired new life. If any of the many rumors are to be believed, Venezuela must soon enter upon a rapid development of its best, but heretofore neglected, territory.

San Felipe will, at an early date, be connected with Puerto Cabello by a line of small steamers and a substantial "tramway," affording unprecedented facilities for exporting the products of that section of the country and distributing the imports, with a certainty, safety, and rapidity heretofore unattained.

The Yaracuy Navigation Company, chartered in the State of New Jersey, with its main business office in the city of New York, has secured control of a Venezuelan concession to colonize and navigate the Yaracuy River, a waterway running through one of the richest forest, coffee, cocoa, and copper districts in the republic. The mouth of the river is 12 miles from this port, and will be navigated for a distance of about 30 miles and then connected with San Felipe (the storehouse and distributing point of that district) by a substantial tramway of about 25 miles. Being the only distinctive American enterprise in this district, other than the electric plant, I am happy to report that I believe this is an actuality and not a syndicate myth. The company has now three small steamers, with apparatus, at work clearing the river of obstructions. It is backed by well known New York capitalists.

MINERALS AND WOODS.

Tradition is that many rich gold and silver mines, worked both by the old Indians and Spaniards, exist in this consular district, not over 50 miles from Puerto Cabello. Fine and valuable specimens of both metals are constantly found, but no systematic efforts have heretofore been made to explore the country. Within the past three months, some of the American capitalists connected with the Yaracuy Navigation Company have sent out a number of New York mining engineers, who are at present prospecting the country. As they have not yet returned and no reports have been received, I am unable at this time to inform the department what success, if any, has attended their search.

This section of the country is noted for its productive copper mines. The Quebrada Company (English) operating those at Aroa have recently shut down mines and smelter owing to the great depression in the copper market. The quality of the ore produced is equaled by few mines in the world.

The Quebrada Railroad, built by the same company, for the purpose of transporting their product to the coast, is still in operation in conjunction with its leased lines—the Great Southwestern Railroad—connecting the large town of Barquisimeto with the coast of Tucacas (105 miles of road in all).

Phosphates, almost pure, are found near the coast, not far from this port, and only await a higher market and capital to develop.

The forests throughout the interior in this consular district consist mainly of hard, fancy cabinet woods, such as mahogany, ebony, lignum vitæ, cedar, green heart, etc., and will no doubt soon become an important item of export, in consequence of the operations of the Yaracuy Navigation Company.

PUERTO CABELLO.

The population of Puerto Cabello is now about 12,000, but as this is the largest port of entry in the country, next to La Guayra, the magnitude of its business cannot be measured by its population. On the other hand, it is one of the most metropolitan towns in the country and is an attractive place, comparatively speaking, containing four pretty parks and a theater, excellent water and waterworks, clean streets for a place without sewerage, pleasant dwellings, and handsome storehouses. Tracks are now being laid for a street tramway, with the object of transporting freight only from the warehouses of the merchants to the wharf, and not intended for passenger service.

The heat here is greatly tempered by the pleasant sea breezes that prevail during the day and evening and the mountain breezes at night, making the mornings and nights pleasant as a general thing throughout the year.

Puerto Cabello has the reputation of being an unhealthy place, and is so indicated in all encyclopedias. This possibly originated in an epidemic of yellow fever confined to some ships in the harbor about the year 1876, during which most of the ships lost nearly all their crews. The fever did not, however, spread to the town, and was brought here by these ships. Since then no epidemic or even an approach to one has appeared, either in town or harbor, and the uncorrected statement does gross injustice to the town. My own residence here enables me to contradict this generally accepted foreign opinion.

COST OF LIVING, WAGES, ETC.

The poorer classes of Venezuelans live mainly on fish and fruits. The few articles of manufactured goods used by them are confined to the most pressing wants and of the commonest grades.

Rent is exceedingly high. An ordinary pleasant dwelling costs from $60 to $80 per month, and what is termed a handsome house rents for from $100 to $120 per month. A house renting for $30 per month would be located in an undesirable, often in an unenviable, quarter of the town, and shabby both in exterior and interior appearance. The luxury our poor enjoy in the way of small, neat, and cheap houses or apartments is unknown in this country.

Table board, with which a foreigner must be content, and to which the better class native is accustomed, costs $35 (United States gold) per month. Flour that sells for $2.50 and $3 per barrel at home costs $10 to $11 gold at the ports and often twice as much and more in the interior towns. Eggs are 40 to 60 cents per dozen; potatoes, 8 cents per pound; meat, 15 to 30 cents per pound; sugar, 16 to 20 cents per pound; and all other imported and native products in proportion.

Though this is an agricultural country, the native seems devoted to raising coffee, cocoa, and like products to the almost total neglect of good vegetables. Hence, we often see the peculiar spectacle of imported vegetables in a country that could with proper management export them.

Incandescent light is furnished at very cheap rates.

SAMUEL PROSKAUER, Consul.

Puerto Cabello, September, 1895.

Train Detentions.

At the December meeting of the New York Railroad Club the subject of the cause of train detentions was discussed. The discussion was opened by Mr. C. M. Mendenhall, of the Pennsylvania Railroad, who had compiled the following table:

CAUSES OF PASSENGER TRAIN DETENTION.

89·3 per cent.	Arbitrary. Traffic. Operation.			
10·7 per cent equipment.	Engines, 55 per cent.	Hot journals	33	per cent.
		Hot eccentrics	3	"
		Steam failures	24	"
		Brake failures	13	"
		Taking water	5	"
		Couplers, Injectors, Steam heat, Markers,	5	"
		Miscellaneous	17	"
			100	"
	Cars, 45 per cent.	Hot journals	48	"
		Brakes	38	"
		Steam heat	4	"
		Parting	5	"
		Miscellaneous	5	"
			100	

This, it will be observed, refers to passenger trains only, and Mr. Mendenhall explained that it does not represent all causes of detention, although we suppose it represents all cases of which he had records available. For example, under the head of Miscellaneous is a considerable group of detentions which could not well be classified, there being so few of them. He assumes one minute as the minimum delay; that is, he means by "late" within one minute of schedule time, and he believes that, if the records are carefully examined, it will be found that 34 per cent of passenger trains will arrive late at their destination. This, of course, will vary in different months of the year. The passenger schedules are generally so slow that more or less time lost can be made up, more in summer and less in winter. He was not able to give the relative number of detentions under the headings Arbitrary, Traffic and Operation, but the total of these three classes he has found to be about 89·3 per cent of all detentions. This leaves 10·7 per cent due to equipment, and of the equipment failures 55 per cent is due to engines and 45 per cent to cars. The further analysis of the causes is shown in the table.—Railroad Gazette.

Typewriter Inks.

Take petrolatum of high boiling point, melt it on a water bath or slow fire, and incorporate by constant stirring as much lampblack or powdered dropblack as it will take up without becoming granular. If the fat remains in excess, the print is liable to have a greasy outline; if the color is in excess, the print will not be clear. Remove the mixture from the fire, and while it is cooling mix equal parts of petroleum, benzine, and rectified oil of turpentine, in which dissolve the fatty ink, introduced in small portions by constant agitation. The volatile solvents should be in such quantity that the fluid ink is of the consistence of fresh oil paint. Apply the ink, after agitation, by means of a soft brush, and rub it well into the interstices of the ribbon with a toothbrush. Hardly any ink should remain visible on the surface. For colored inks use Prussian blue, red lead, etc., and especially the aniline colors. For black try the following:

Aniline black	½ oz.
Alcohol	15 fl. oz.
Glycerine	15 fl. oz.

Dissolve the aniline black in the alcohol, and add the glycerine. Ink as before.

TYPEWRITER COPYING INK.

Transparent soap	1 oz.
Glycerine	4 fl. oz.
Water	12 fl. oz.
Alcohol	¾ fl. oz.
Aniline dye	Sufficient.

Dissolve the soap in the water and glycerine, with the aid of heat; dissolve the aniline in the alcohol, and mix the two solutions. If the ink is too soft, add more soap.—T. L. L.

Gets a Medal for Speed.

Engineer William Tunkey, who pulled the Lake Shore's record-breaking train from Erie to Buffalo last October, has just been given an elaborate silver medal by W. K. Vanderbilt and W. Seward Webb. Mr. Tunkey's ability as an engineer saved this trial of speed from being a failure, for when the train reached Erie it seemed irretrievably behind the scheduled time, and Mr. Tunkey's quick work saved the day. The medal given to Mr. Tunkey is of solid silver, weighs nearly two pounds, and is a work of art.

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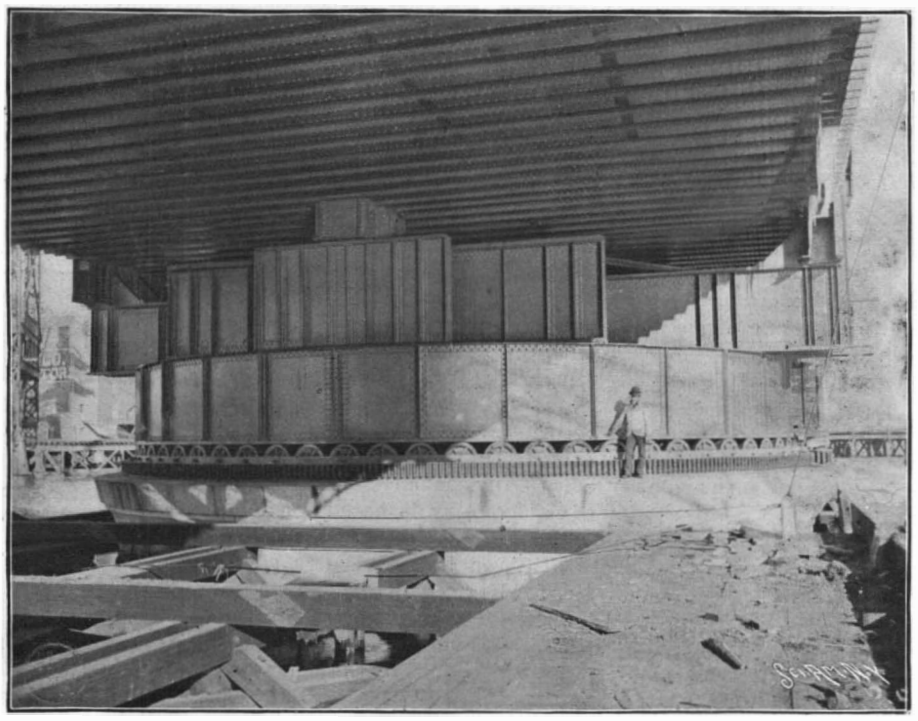
THE HARLEM RIVER DRAWBRIDGE AND THE PARK AVENUE IMPROVEMENT IN NEW YORK CITY.

New York City possesses within its limits, on Manhattan Island, a single large railroad station, known as the Grand Central Depot. Into this depot the cars of practically three lines of railroad run down from the Harlem River to Forty-second Street, a distance of nearly five miles. This distance has for a long time been traversed partly through cuts, partly through a tunnel and partly on a masonry viaduct. The upper part of Park Avenue, from 106th Street to the river, which is really a continuation of Fourth Avenue, is now being improved by the removal of the viaduct and cuts, and the substitution therefor of an elevated steel structure, on which four tracks will be carried. The effect of this will be to throw open the street below to the public, leaving a width of 140 feet unobstructed except by the three rows of columns of the overhead structure. We have already illustrated the operation of the construction of this elevated way, which is now rapidly approaching completion.

A high level bridge is now almost completed over the river, which bridge is practically the largest railway drawbridge in the world and one of the very few four track structures in existence. Our illustrations show the present aspect of the improvements and of the bridge itself.



THE DRUMS ROLLERS AND GIRDERS UNDER DRAW SPAN HARLEM BRIDGE.

The viaduct is a steel structure carried on three rows of columns, each row supporting a longitudinal plate girder 7 feet 2 inches deep, ⅜ inch steel being used for the side and $\frac{9}{16}$ for the center girders, the theory of construction being, of course, that the center girder sustains double the weight of the lateral ones. The space between the girders is bridged over by New York Central solid floor system of cross trussing, which consists practically in a series of three-sided box girders covering the entire space, the longitudinal axis running across the structure. These act at once as roof, floor, truss and sleepers, and on them the rails will be laid. Drainage and leader pipes carry off the water, so that the street beneath the elevated way will be practically roofed over. This portion of the work is supplied by the Elmira Bridge Company, of Elmira, New York.

The small cut shows the full construction adopted on the viaduct. The high level bridge is the most impressive part of the improvements, and has the following general dimensions and features: On the north there are two bridge spans, the one farthest north being 131 feet 4¼ inches and the next 185 feet 4½ inches, these trusses being respectively 26 feet 3¼ inches and 30 feet 10¾ inches high. The draw span, measured from center to center, has a length of 389 feet, its length over all being about 400 feet. Its breadth is 58 feet 6 inches from center to center of the outside trusses, being carried by three trusses, one central and two lateral ones, the center one being the heaviest. These trusses provide two clear ways across the bridge, each 26 feet wide, and in each of the trackways are two tracks. At the center the draw span is 64 feet high and at the ends 25 feet, all measurements being taken from center to center.

The 121 foot span weighs 475 tons and the 185 foot span 850 tons, while the great draw span weighs 2,500 tons. It is of the pinned truss construction, and some idea of its dimensions may be obtained from the fact that the principal top pin of the hip, next to the tower, is 11 inches in diameter, while the bottom pin of the center truss next the tower is 12 inches in diameter. These pins are all steam forgings, turned up to shape. Other dimensions are worth citation.

The bottom chord of the bridge, which chord has a double role to fill—acting at once as a truss member when the bridge is open and also as a girder between the successive panel points, to support the weight of passing trains—is 48 inches deep. The tension members, extending from the top of the tower to the hips of the girders, consist each of eight bars of steel 10 inches by 1¾ inches, representing in the aggregate a cross section of nearly a square foot of steel. One could easily go through the whole structure and quote the dimensions, but we are merely giving enough to afford an idea of its great size. The floor of the bridge, which is carried directly by the bottom chords, is of the same solid floor system as that used in the elevated way, the troughs being 18 inches deep. The rails are laid directly on this floor.

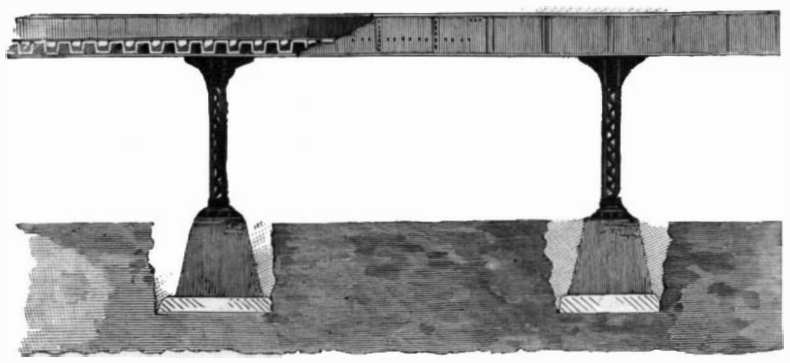
The draw span of the bridge is carried on two concentric drums 4 feet apart, the outer one being 54 feet in diameter, the inner one 46 feet in diameter. Under each of these drums is a circle of seventy-two cast steel rollers turned to a perfectly true conical alignment, the outer rollers being 24 inches in diameter, the inner ones $20\frac{7}{16}$ inches in diameter, and both being 10½ inches face. The entire weight of the draw span when open rests upon these 144 rollers. The outer circle of rollers can be seen very clearly in the different cuts representing the bridge, especially in the one showing the center bearing. Of course, only the outer drum can be seen. The drums are stayed together by sixteen radial lattice struts, and the rollers, although journaled, so that they appear to be wheels, really act as true rollers in the operation of the bridge. On top of the drums is a series of eight steel beams, parallel and of varying length, representing chords of the circle of the drum, and on these beams the draw span, when open, is carried, so that there are provided thirty-two bearing points on the two drums, for this set of girders and for the draw span. All this is clearly shown in the view of the bridge and in the small view of the bearing. The drums are 6 feet high.

Merely to keep the bridge bearing in position, a center pivot casting is supplied, but the entire weight of the draw span, when open, comes upon the rollers. The center casting will have absolutely no work to do in carrying weight. The bridge is turned by steam, the engine house being situated above the tracks within the central tower of the structure. Here are installed two oscillating, double cylinder engines made by Edwards & Company, of New York. The cylinders are 10 inches in diameter and have 7 inches stroke.

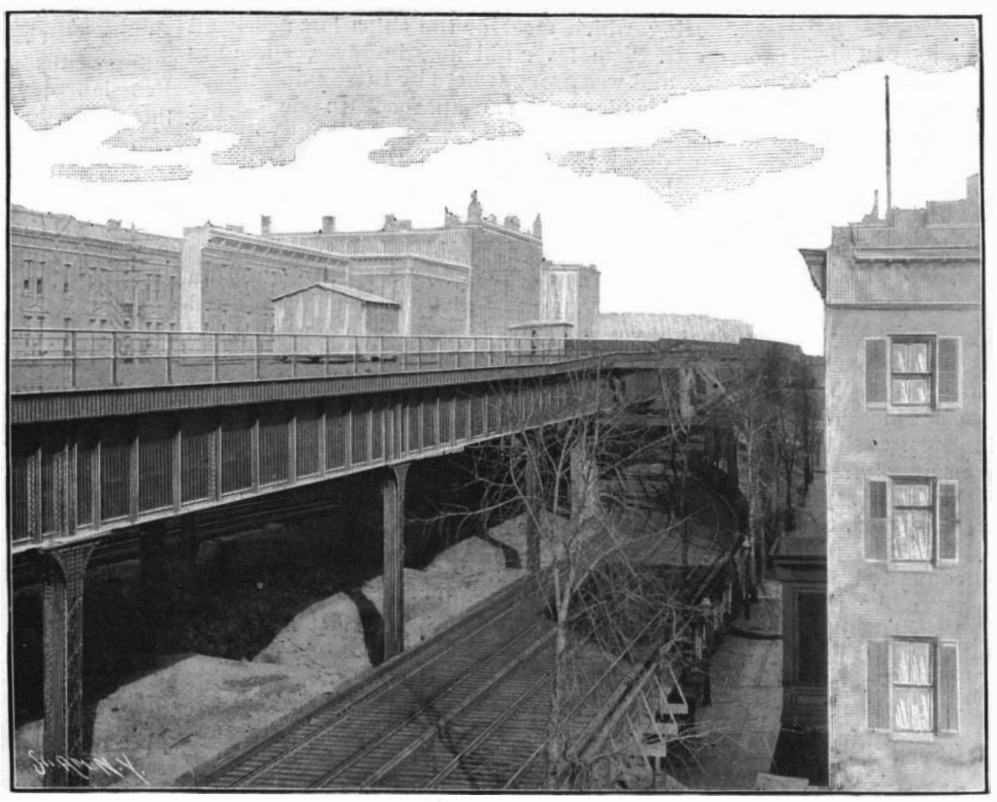
The weight of the draw span is only partly taken up by the central bearings when it is closed. For each end there are levers arranged somewhat like toggle joints, which are operated from the center tower by steam power. When closed the levers are drawn together so as to take part of the weight of the ends, so that when the draw span is closed and the bridge is ready for the passage of trains the draw span acts partly as two through trusses and partly as two cantilever arms. When the draw span is to be opened, the levers are moved so as to give 3 inches clearance for the ends of the bridge. This is not all that is needed. The ends of the rails have also to be swung upward to clear the alignment chairs used to secure a perfect joint for the passage of trains.

The reverse of these operations is carried out when the span is closed. A masonry structure is shown at the end of the viaduct, where it meets the bridge. This represents architecturally a stone abutment, but really it is of little utility, having been placed there almost entirely for architectural reasons.

The draw span rollers and approaches were built by the King Iron Bridge Manufacturing Company, of Cleveland and New York. Our thanks are due to them for courtesies received in connection with this article.



THE CONSTRUCTION OF THE ELEVATED WAY.



NEW ELEVATED ROADWAY ON PARK AVENUE AND PRESENT TEMPORARY TRACK.

Waterproofing Brick and Sandstone.

A number of experiments were recently made to ascertain the length of time that brick and sandstone are rendered waterproof or protected by oil. The three oils used were linseed oil, boiled linseed, and crude mineral oil. The amount of oil and water taken up by the sandstone was very much less than that absorbed by the brick, although the area of the sandstone cube was much greater. Equal amounts of the raw and boiled oil were absorbed. The mineral oil, however, was taken up in much greater quantities by both brick and sandstone. By the end of twelve months the mineral oil evaporated from the bricks, but such was not the case when the other oils were used. After an exposure of four years the bricks practically retained all their oil, inasmuch as they had not lost any of their weight, and were also nearly impervious to moisture. It was noticeable that the sandstone cubes treated with linseed oil returned to their original weights, but do not appear to have lost the beneficial effect of the oils, being also practically waterproof.—Mining and Scientific Press.

As speaking tubes do not work on the English war ships owing to the rattling of the machinery, the Admiralty will try telephones.

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A Costly Patent.

One of the Paige typesetting machine patents, recently issued, "breaks the record" in the history of the patent business for the great bulk and complexity of the patent itself and the intricacy of the machine it covers. It is said that over a million dollars was expended on the machine before the construction of the first one was completed. It has no less than 18,000 separate parts, and does the setting, justifying, and distributing of type in a way which would be satisfactory were it not for the cost and complexity of the machine. In the development of this invention Mark Twain is reported to have invested nearly $250,000.

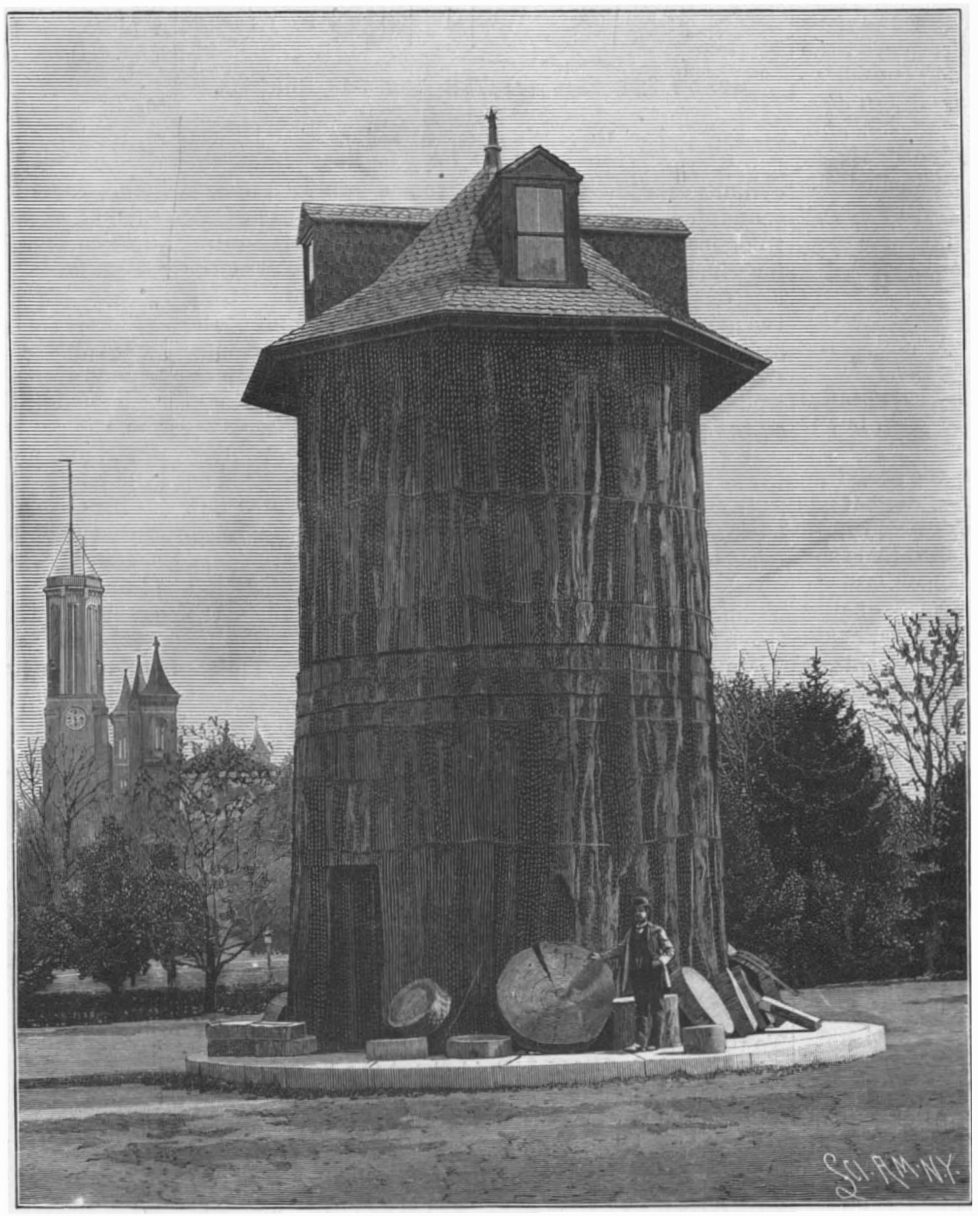
The first application filed for a patent on it contained 204 sheets of drawings, having over 1,000 separate views. During the eight years the case was pending in the office before allowance, the number of sheets was reduced to 163. When it is remembered that the majority of patents have only a single sheet of drawings, and that to require as many as ten sheets is an exception, the magnitude of the invention can be understood. The fees charged by the Patent Office are uniform for all cases, no matter how complex or how simple—$15 on filing the case and $20 additional on allowance of the patent.

When this case was filed it was turned over to an examiner who received a salary of $1,800, and he spent six weeks in studying the case before being able to take the first action. The entire specification was twice rewritten, each time by a different attorney. How much this cost the inventor is not known, but it is safe to say that the Patent Office lost heavily. It is estimated that it consumed about $1,000 worth of the time of the various Patent Office officials before maturing into a patent, and when issued the usual rule had to be followed of preparing copies for sale at the regulation price.

The large number of sheets of drawings had to be photo-lithographed and the entire body of the specifications and claims set up in type, costing for the first edition, as estimated by the ordinary rules, a few cents over $6 a copy. These copies were sold to the public at the usual price until the first edition was exhausted, when the Patent Office stopped the issue. A great many people ordered copies of this patent out of curiosity.

A TRANSPORTED CALIFORNIA "GREAT TREE."

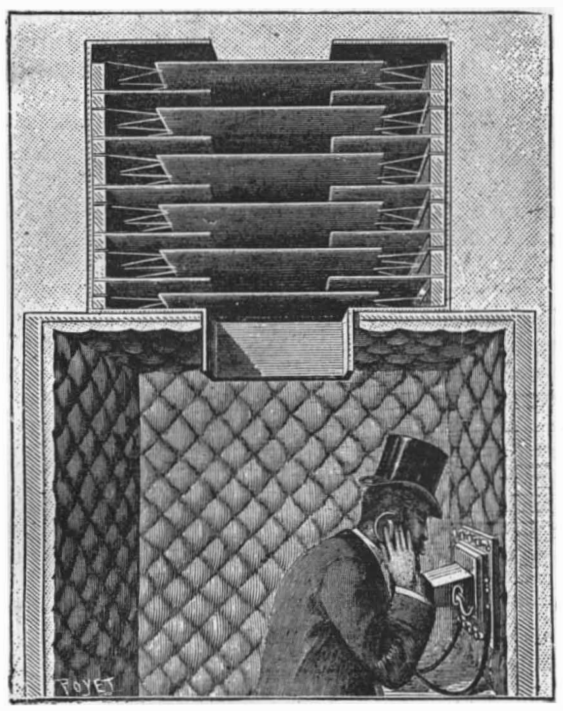
The accompanying illustration shows the great tree General Noble (named after General Noble, late Secretary of the Interior) as it now stands in the mall at Washington, D. C., between the Agricultural Department building and the Smithsonian Institution, which is shown in the distance. Among the multitudinous marvels of nature, none surpass in majesty and grandeur the great trees of California; no such trees are found in any other part of the world; they were first discovered in 1852 by a hunter, Mr. A. T. Boyd, and at once attracted general attention, and attained the widest celebrity. The genus, a species of redwood (Sequoia gigantea), was named in honor of Sequoia (pronounced Sequoyal), a Cherokee Indian of mixed blood. This specimen was 26 feet in diameter at base, 81 feet 6 inches in circumference and 300 feet in height, the section being taken about 20 feet from the ground; although considerably smaller than some others, it was found to be comparatively well preserved and symmetrical. It had to be hauled by teams of sixteen mules each, on heavy trucks built for the purpose, a distance of sixty miles on a rough mountain road; price paid for cutting, hauling and delivering on cars was $7,500; section was divided into forty-six smaller sections, some of these pieces weighing over four tons; it took eleven cars to transport it to Chicago, where it was exhibited at the Exposition; total cost of hauling and installing at the Exposition was $10,475.87; the additional expense of placing it in its present position would probably make a grand total of over $12,000. As will be seen by plan, the interior diameter is about 13 feet, and average thickness about 20 inches; a circular iron staircase leads to platform about 18 feet above; it has been roofed over and shingled with round butt shingles painted red; four dormer windows light the interior. Our engraving was made from a photograph taken specially for the SCIENTIFIC AMERICAN.



A CALIFORNIA "GREAT TREE" IN WASHINGTON.

A VENTILATOR FOR TELEPHONE CABINETS.

Telephone cabinets are so arranged as to smother sounds, as well as those who remain in them. In order that the conversation, which is to be carried on in a loud voice, shall not be heard outside, no provision is made for the least ventilation. It is well known how difficult it sometimes is in Paris to obtain communi-



MENIER'S VENTILATOR FOR TELEPHONE CABINETS.

cations, and it is a genuine punishment when it becomes necessary to remain ten minutes in one of these silk padded boxes.

We recognize the fact that the question is quite a delicate one; for, on the one hand, although for many reasons it is necessary to assure the ventilation of the cabinet, it is also indispensable to guarantee the secrets of conversation in an absolute manner, as it often has reference to important family or business matters in which those interested should alone take part. So we think it well to make known to those whom the question interests a simple and ingenious arrangement devised by Mr. H. Menier and applied for some months past in his offices.

In the top of the cabinet there is formed a wide aperture over which is placed a box open at the top and bottom. In the latter are arranged, one above the other, a series of boards, of the same size as the box, resting upon ledges and covered with cloth. In the center of each of these there is a wide square aperture. Other and smaller boards, likewise covered with cloth, but supported by cords attached to the sides of the box, are interposed between the first. This obstructive arrangement gives the air a wide circulation, and, as proved by experience, completely annuls vibrations. In order to assure himself of this latter condition, Mr. Menier installed one of these apparatus over an aperture formed in a wall separating two rooms, and found that two persons standing at the distance of three feet on each side could not converse, even in a loud voice.

This arrangement therefore completely solves, at slight expense, the double problem of ventilation and the smothering of sound.

We are indebted to La Nature for the illustration and article.

Discoveries in South Russia.

Our Odessa correspondent tells us that the curator of the St. Petersburg Imperial Archæological Committee, Mr. Goshkevitch, has made some archæological discoveries along the banks of the Dnieper (Borysthenes) and the Bug (Hypanis). Opposite the village of Kisliakovka are the ruins of the ancient town of Olbia, described by Herodotus as surrounded by a wall with many towers, and distinguished for its extensive trade and its civilization. The ramparts and inner parts are well preserved, and terra cotta figures with subjects from domestic life, pottery, and small vessels are continually being discovered by the villagers. The number of ancient sites discovered by Mr. Goshkevitch is 15. Each is situated on the steep bank of the river, which forms a natural defense against surprise attacks, and the other three sides are surrounded by ramparts in a good state of preservation, with the ruins of dwelling places within the walls. At Propastnoe, on the edge of the ravine of the same name, many ancient Greek vessels were found, and both here and on the banks of the Bug were found pieces of money of the time of Emperor Theodosius the Great, who reigned near the end of the fourth century. In the village of Kisliakovka evident traces were discovered of an ancient Greek settlement, and the curator discovered a head of a statue. The peasants a short time ago unearthed a splendid Greek statue, but, being ignorant of its value, they destroyed it, although they sell to the first buyer the coins they find at the ancient site of Olbia, and many private persons in those parts have splendid numismatic collections of the Scythian and other periods.

In a tumulus near the well-known Borysthenian burying ground was found a vault-like chamber, faced with oak blocks, and a floor made white with cement or lime. A skeleton was lying on a stone slab with extended arm bones and on the wrist a bracelet of pure gold. Around the neck were four finely worked gold and amber necklaces, and at the hip bone was a kind of knife or sword. Thirty bone arrows in a quiver, as well as a corytos or bow case, were near the skull, but the quiver crumbled away on exposure to the air. The skeleton crumbled to dust on being touched. Mr. Goshkevitch thinks it belongs to the Scythian period. In a ravine opening up into the valley of the Borysthenes (Dnieper) a considerable number of mammoth bones were discovered.

The curator has brought away to the Kherson Museum a massive piece of statuary having on its two sides crosses and cypress leaves, as well as a bunch of "prisob." This work is believed to belong to the period when the Genoese colonies were flourishing on the shores of the Black Sea.—London Times.

Elvind Astrup.

Elvind Astrup, who was Lieut. Peary's companion on his first trip across the inland ice, and who was with Mr. Peary on his second and third expeditions, started a few days before Christmas for the purpose of making a ski excursion in the mountains of Norway. Three weeks having elapsed, his friends became alarmed and sent a party to search for him. Astrup was found frozen to death in the Lille Elvedal Valley, in the Dovrefjeld Mountains. He did excellent work when with Mr. Peary and gave great promise of being an independent Arctic explorer of note.

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Experiments on the Poisonous Action of Acetylene.*

Thanks to the extreme kindness of M. Moissan, who has given me a sufficient amount of calcium carbide to prepare several hundred liters of acetylene, I have been able to make a series of comparative experiments, which I have the honor of presenting to the academy.

I caused to be introduced into a mercury test glass, well dried, 400 grammes of carbide of calcium. A rubber cork pierced with two holes received a glass funnel with a cock in it and the other end a conducting tube, which carried the gas obtained by the flowing of water, through the glass retort, which allowed the regulation of the outflow; when all the air had been forced out, and when the gas obtained burned without explosion, the acetylene was received in a gasometer (model of Dr. Saint-Martin).

I successively titrated mixtures of acetylene, of air, and of oxygen, adding always 20·8 of oxygen as in the atmospheric air.

Mixture of 20 to 100.—I caused a dog to breathe a mixture composed of 20 to 100 of acetylene; the animal remained quiet; the respiratory movements became larger in extent. At the end of 35 minutes, 44 c. c. of arterial blood was injected into the empty receiver of the mercury pump, and I extracted the gas which had been collected over the mercury, in a little bell with a glass cock; after the absorption of the carbonic acid by potash, the gaseous residue was introduced into the fire damp indicator, whose receptacle had been filled with three quarts of air, and the gaseous mixture was contained in the receptacle and in the entire length of the graduated tube. At the first passage of the current, we saw a very clear blue flame and a detonation was produced with a sharp sound; the reduction was equal to 82·4 divisions and indicated a considerable volume of acetylene, which had been absorbed by the blood; 1 c. c. of acetylene giving a reduction three times as large as that of carbonic oxide gives; that is to say, $3 \times 6{\cdot}6 = 19{\cdot}8$ degrees in my fire damp indicator; 100 c. c. of blood contained 10 c. c. of acetylene.

Mixture of 40 to 100.—The oxygen of Passy contains 90 to 100 of the pure oxygen. In order to obtain a mixture of acetylene of 40 to 100, the calculation indicated that it was necessary to add 55 liters of this gas, 66 liters of air, and 16·5 liters of oxygen, in order to prepare a mixture containing 79 of acetylene and 20·8 of oxygen. A dog who breathed this mixture, after having presented a long period of agitation, circulated in its lungs 112 liters of the mixture. Suddenly, 51 minutes after the commencement of the experiment, the animal extended its paws and died; the heart had stopped; we drew off the blood into the lower vena cava; it revealed in the fire damp indicator the presence of 20 c. c. of acetylene in 100 c. c. of blood.

Mixture of 79 to 100.—I made a mixture of acetylene and oxygen in which combustible gas replaced the nitrogen of the air. At the end, a dog caused to breathe this mixture presented a continual agitation and very ample respiratory movements. Eleven minutes afterward, we observed general convulsions; 27 minutes after the commencement, he extended his paws, and there were some painful respiratory movements, which preceded death.

This mixture of 79 to 100 was conducted into a bell formed glass jar in which there was a guinea pig. In 6 minutes the animal fell upon its flank; had convulsions, fluttering movements of the limbs and of the head. At the end of 39 minutes, we drew out the animal, which rested flat on its flank. Some minutes later the guinea pig raised itself and revived, but it died during the night.

I concluded from my experiments that the acetylene is poisonous when one employs a strong dose, if administered in large doses between 40 to 100 and 79 to 100. The employment of the fire damp indicator easily allowed the discovery of this gas in the blood.

I endeavored also to compare the poisonous quality of acetylene with that of illuminating gas. Starting from the fact often proved by analysis that coal gas (illuminating gas) contains 7 to 100 of carbonic oxide, I made a mixture of 150 liters of air, 5·3 of oxygen, and 20 liters of coal gas, which should contain 1 to 100 of carbonic oxide and 20·8 of oxygen. A dog forced to breathe this mixture presented at the end of 3 minutes a lively agitation, and at the end of 6 minutes very violent movements of agitation. We took, 10 minutes after the commencement of the experiment, blood from the carotid artery, and from 100 c. c. we could withdraw 27 c. c. of carbonic oxide. The dog when released remained lying on the floor—was very sick; and if the experiment had lasted some minutes more, it would have died. Illuminating gas is, therefore, much more poisonous than acetylene.

*By M. N. Grehant, in Comptes Rendus.

Exposition at Montreal.

The British Empire Exposition and International Display of All Nations will be held in Montreal, Canada, from May 24 to October 12, 1896. The plans of the exposition include an electrical display, and the successful exhibitors will receive handsome awards.

Correspondence.

ELECTRIC IGNITERS FOR GAS ENGINES.

To the Editor of the SCIENTIFIC AMERICAN:

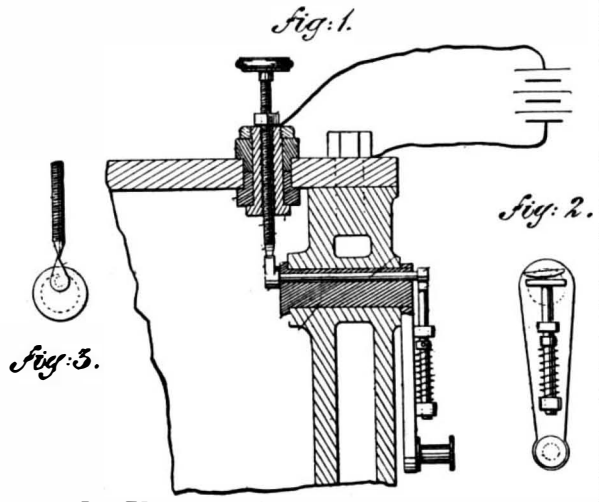
Allow me to call your attention to the fact that the rotary spark arrangement, Figs. 3 and 4, in an article on "Electric Igniters for Gas Engines," by George M. Hopkins, in your issue of January 11, is covered by my patent No. 546,238, of September 10, 1895, which particularly describes and claims the eccentrically bored spindle. FRANK S. MEAD.

Montreal, Canada.

[The several devices illustrated in the article referred to are based on the principle of the ordinary electric igniter used in connection with burners for illuminating gas. These illustrations were given merely as suggestions, leaving it to the reader to make the practical application. When this article was published the writer did not know that there was in existence a patent for a device similar to one shown in the article.

As Mr. Mead has called our attention to the similarity existing between his device and that of one of the illustrations, we reproduce some of the figures shown in his patent. This igniter is arranged to give a strong spark from a current derived from a battery, which insures the ignition of the explosive mixture at the proper time, and although no spark coil is shown in the circuit of the battery, we presume it was the intention to use a coil.

As shown in Fig. 1, the cylinder of a gas or oil engine is provided with the usual jacket, the end of the cylinder being closed by a cylinder head. In the cylinder wall is mounted a rock shaft connected at its outer end with a crank arm, as shown, or the shaft may be provided with a wheel receiving rotary motion from some revolving part of the engine. In the shaft is mounted eccentrically an electrode provided at its outer end with a cross bar on which presses the head



MEAD'S ELECTRIC IGNITER FOR GAS ENGINES.

on the end of the spring-pressed rod carried by the crank arm. On the end of the electrode within the cylinder is secured a pointed arm, as indicated in Fig. 3, adapted to engage the pointed end of a fixed electrode inserted in a sleeve held in the insulating bushings in the cylinder head. On the upper end of the electrode is secured a hand wheel to facilitate setting the point in proper position relative to the point of the arm of the movable electrode. A wire from an electric generator is connected with the adjustable electrode, and another wire from the generator is attached to some part of the cylinder.

It will be seen that when a rocking motion is given to the shaft by the crank arm, the spring-pressed head engages the cross bar, causing the movable electrode to move in line with the crank arm, and the oscillating electrode is moved into contact with the point of the fixed electrode, and by turning in its bearings in the shaft it finally passes the fixed electrode and produces the spark which ignites the explosive mixture in the cylinder. A similar result is obtained when a complete rotary motion is given to the shaft.

In the article to which reference has been made it was suggested that a small dynamo had been used successfully for producing the ignition. A correspondent has inquired as to the method of using a dynamo for igniting the explosive mixture. The dynamo is driven by the engine, and its terminals are connected with the movable and fixed contact points. When the points are separated, a spark is produced by the extra or self-induced current of the dynamo. No coil is needed.—Ed.]

Call for a Motor Driven Sleigh.

To the Editor of the SCIENTIFIC AMERICAN:

We hear a good deal said about the horseless carriage. Why not take the sleigh in hand and move that with a similar motor? Such a sleigh would require the addition of a driving wheel back of the seat and midway between the two runners. This wheel would have a semi-free vertical movement and would be kept close to the road's surface either by weighting or by a spring or springs above it. It would need to be light, should have a polished surface, and should be rimless at edge, thus offering little, if any, chance for snow to adhere to it. At points around the margin of the wheel, two or three inches apart, little projecting spurs would give it the required hold upon the road to insure a forward movement to the vehicle. This wheel would get its motion from a crank or band connected with the oil or other motor, under the seat, as in the horseless carriage.

To guide our sleigh, a rudder-like fixture would be attached to the rear end of each runner, and the two would be moved, in concert, by the sleigh's occupant.

A long brake, following the side of each runner, would have a roughened or lower surface, which would be brought to bear lengthwise upon the snow coating of the road by a bar, in the usual place, at the side of the carriage seat.

It seems to me the successful horseless sleigh is an easier problem to solve than that of the horseless carriage.

As to its rapidity of movement, it might easily outstrip the ordinary railroad train, if the road traveled would admit of it, or the occupant could bear the lively stirring up. B. F. LEEDS.

San Diego, Cal., December 6, 1895.

Care of Books.

Even to those who are most careful and particular with their loved and treasured libraries accidents will happen, and the human bookworm is at his or her wits' end to remove the difficulty, which threatens perhaps to ruin forever one or more of the choicest volumes.

An English magazine lately published the following items, which will probably be found useful by any librarian:

To remove ink stains from books—A small quantity of oxalic acid, diluted with water, applied with a camel's hair pencil and blotted with blotting paper, will, with two applications, remove all traces of the ink.

To remove grease spots—Lay powdered pipeclay each side of the spot and press with an iron as hot as the paper will bear without scorching.

To remove iron mould—Apply first a solution of sulphuret of potash and afterward one of oxalic acid. The sulphuret acts on the iron.

To kill and prevent bookworms—Take one-half ounce of camphor, powdered like salt, one-half ounce bitter apple, mix well, and spread on the book shelves. Renew every six months.

To polish old bindings—Thoroughly clean the leather by rubbing with a piece of flannel; if the leather is broken, fill up the holes with a little paste; beat up the yelk of an egg and rub it well over the covers with a piece of sponge; polish it by passing a hot iron over.

Do not allow books to be very long in too warm a place; gas affects them very much, Russia leather in particular.

Do not let books get damp or they will soon mildew, and it is almost impossible to remove it.

Books with clasps or raised sides damage those near them on the shelves.—Inland Printer.

Calcic Carbide as Motor Fuel.

The Gas World quotes some interesting figures given by Dr. Adolph Frank, of Charlottenburg, in a paper communicated by him to a foreign contemporary, and recommending the direct use of calcium carbide in motors, the gas being liberated as required by means of water, and not carried about in a compressed state in cylinders. According to the authority quoted, both the Bitterfeld and the Neuhausen works have improved their products up to 90 per cent yields, and, it is added, a price of 90s. a ton does not now look at all unlikely. The theoretical yield of acetylene is 26 pounds per 64 pounds of carbide, and the extra weight, that of the calcium, is a small matter in comparison with the expense and risk of fifty-atmosphere cylinders. Curiously enough, the liquefied acetylene obtainable from a given quantity of carbide occupies, as nearly as possible, twice the volume of the carbide itself.

The data arrived at are, for a 1,000 horse power marine engine, worked for 600 hours: Coal, at 1·54 pound per horse power per hour, 420 tons, occupying a space of 420 to 430 cubic meters; liquid acetylene, at 0·396 pound per horse power per hour, 108 tons, filling cylinders of an aggregate capacity of from 270 to 300 cubic meters, and of sufficient strength to withstand a pressure of 50 atmospheres; carbide of calcium, 90 per cent, or 36·56 per cent of acetylene by weight, total required, 300 tons, occupying 131 cubic meters only. In the last case the whole, which required protection from damp, etc., would not bring the space occupied up to 150 cubic meters. This (our contemporary remarks) is a very remarkable comparison in view of cases where storage capacity is all important, for the whole of the steam boilers would at the same time disappear; but, of course, in the meantime the price of carbide stands in the way of the practical adoption of acetylene for motor purposes.

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Wampum.

This is the English name for the shell beads used for ornament and as currency among the northern tribes of Indians previous to the settlement of the country. They were made chiefly on Long Island and around New York Bay, and were of two kinds, one made of conch or periwinkle shells and the other of hard clam shells. The making of wampum, to be sold for ornaments, has been carried on for nearly a hundred years by the Campbell family at Pascack, N. J., and they are now said to be the only persons who know how to bleach and soften the conch shells used in making white wampum or to drill holes through the still harder clam shells that are made into the more valuable black or deep purple wampum. The conch shells are brought from West Indian ports by schooners. The clam shells are of the largest size obtainable, the smaller ones being too thin for the purpose.

The white wampum and hair pipes are, according to the New York Sun, made from the lip of the shell, which is cut into suitable sizes after being detached from the body and put through a softening process that also bleaches it white. The hair pipes are somewhat thicker than a clay pipe stem, tapering from the center to both ends, and are graduated in length, by half inches, from one to six inches. They have a hole through the center lengthwise. They were used to ornament the long hair of the chiefs, which was run through the holes and secured with gaudy colored strings.

Black or dark purple wampum has always been more costly than the white because it was worn only by the chiefs and medicine men and because of the difficulty of drilling the holes. But a small portion of a clam shell yields material of the proper hue, and when it is cut in sections there is so much waste by breakage that only the most expert workman can be intrusted with the task. The dark shell is cut in lengths like the white. A number of sections having been drilled, they were, according to the old process, strung on a wire and placed in alternating grooves running around a fine grindstone. As the stone revolved Rockaway sand and water were dropped on it and a piece of hard board was rubbed back and forth across the face, thus moving the wampum and rounding its outer surface. Then it was washed, dried, dipped in olive oil to give a gloss, and afterward made into strings for market. The clam shell could not be softened without ruining its color.

NEW ARMY BICYCLES.

The new army tandem and the model 40, mounted with a Colt's automatic machine gun, which have been made by the Pope Manufacturing Company, were exhibited at the Madison Square Garden Cycle Show and attracted great attention.

The tandem is one of the Pope Company's regular model 43s taken directly from stock and finished plainly in enamel and nickel. On the front handle bars are tightly strapped two army overcoats, and on the rear bars a pair of blankets. Resting safely in brackets on either side of the machine is a twelve shot repeating rifle, and hanging on each seat post a Colt quick action revolver of the latest pattern. In addition to this there is a case of signal flags extending almost the whole length of the machine, but not interfering with the riders in the least; and this is the case with all the equipments, being as well and safely placed, ready for use in a moment, and yet causing not the slightest interference.

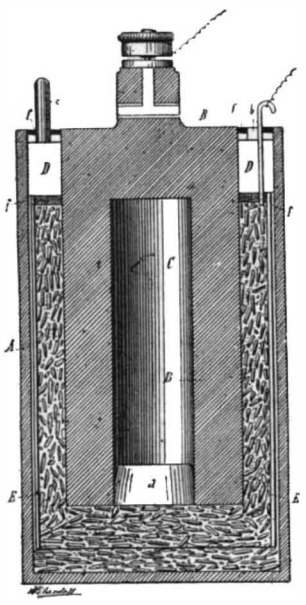
The Colt automatic gun mounted on the model 40 is the one recently adopted by the government for our navy. This gun weighs between thirty-nine and forty pounds, shoots two hundred and fifty or five hundred times—being automatically fed—and is remarkably accurate. It is fastened securely to the head of the machine, can be easily directed at any angle, and does not interfere with the rider or affect the steering of the machine.

These two wheels are as perfectly equipped with the necessary accouterments of war as would seem possible, and the interest which army people and civilians alike have shown in them leads one to believe that it will not be long before the wheel will form a very effective adjunct to regular army service.

IT is proposed to construct a railroad from the city of Mexico to the harbor of Acapulco, on the Pacific coast. Acapulco has one of the finest lock harbors to be found anywhere, with 25 feet of water, and capable of floating all the navies in the world.

A NEW DRY BATTERY.

The battery represented herewith is said to be more durable than its congeners when not in operation. It consists of a glass vessel, A, in which is placed a carbon electrode, B, and a zinc one, E, which is closely applied to the inner surface of the vessel. In the carbon electrode there is a cavity, C, which may be filled with any kind of depolarizer and then be closed with a stopper, a. The space between the zinc and the carbon, as well as the lower part of the battery vessel, is filled with chopped rye straw, to which adheres bichloride of mercury, and which is quite strongly compressed. This filling extends to within three-quarters of an inch or an inch and a half of the upper



NEW DRY BATTERY (VERTICAL SECTION.)

edge of the vessel, so that a space may be reserved for the reception of the liquid before the reaction is brought about. Upon the filling, moreover, there is placed a cap of hemp, f, designed to prevent the element from emptying when it chances to be inverted. The aperture of the glass, likewise, is closed with a cap of hemp, f', impregnated with a resinous substance, and to which is applied a coating of asphalt cement. Finally, three filling apertures are formed in the cover and are closed with stoppers, c.

After the liquid that is to dissolve the exciting salt of the battery has been introduced, the electric current produced decomposes the bichloride of mercury into chlorine and mercury. The latter amalgamates the zinc, and thereafter prevents it from being attacked when the battery is at rest. As for the chlorine, that combines with the hydrogen of the reaction and forms hydrochloric acid, which, when the battery is not in operation, dissolves the layer of oxide of zinc, and thus permits of a new attack of the positive electrode over its entire surface.

At rest, the element, however, remains perfectly dry, and so no reaction occurs, and it loses neither its electromotive force nor the force of its current. Thus is explained the longer duration of this new battery.—La Vie Scientifique.

Egypt's History Traced from its Plants.

Dr. Schweinfurth made recently before the Egyptian Geographical Society, of Cairo, an address on the origin, or, more exactly, on the history, of cultivated plants in Egypt. He spoke in the first place on the route of the Hamitic race to the Nile valley, and concluded that they first lived in Northern Abyssinia and Southern Nubia as cattle breeders. From this point a nation of herdsmen could easily spread, and they certainly brought the ass with them from Somaliland and Nubia—an animal that had been used by man in Africa from prehistoric ages. The agriculture, literature, and religion of the ancient Egyptians were connected in the widest sense with the cultivation of plants. If all means of historical research are directed toward this subject, we find that of the 1,320 existing plant species of Egypt, of which 150 are useful plants, cultivated in great quantity, only 50 species of the latter were known before the Christian era, of which 40 are pictured on the monuments and the remaining 10 are mentioned in the inscriptions. If we would have a conception of the agriculture of the ancient Egyptians, we must exclude fully two-thirds of the plants cultivated in Egypt to-day. Dr. Schweinfurth distinguishes six epochs, according to the kinds of plants that were introduced into the country, as follow:

Epoch I.—Egypt is covered with grassy plains and forests, inhabited by the primitive African race, now extinct. Part of the cultivated plants belonged to the primitive flora of the Nile valley, whose representatives yet flourish over about 15° of latitude. . . .

Epoch II.—Colonization of Egypt by the Hamitic race. Disappearance of the forests, spread of the pastures, beginning of agriculture.

Epoch III.—Beginning of civilization; development of religion and art. Introduction of frankincense; acclimatization of the sacred trees of Arabia. . . . Toward the end of this epoch the cereals were brought in from the Euphrates valley. Beginning of the cultivation of corn, barley, flax, and the vine.

Epoch IV.—Epoch par excellence of Egyptian agriculture. The three kingdoms and the Lybian-Ethiopian domination.

Epoch V.—Egyptian agriculture spreads to foreign lands and the land receives in return many useful plants from abroad. This epoch includes the Persian, Greek, Roman, Byzantine, and Arabian periods.

Epoch VI.—Decay of Egyptian agriculture, about A. D. 1517. In the latter half of this epoch a regeneration followed and a return to civilization. By means of the Venetians the land received useful plants from America, such as maize, tomatoes, sweet potatoes, pimento, and tobacco. Tropical Africa gave it sesame, rice, sugar cane, and sorghum; Arabia, the sycamore, the fig, the pomegranate; Babylonia, cereals, speltz, corn, barley, etc. . . . and America again the most valuable of all her plants, namely, cotton.—Gaea, Leipsic.

NEW ARMY BICYCLE MOUNTED WITH A COLT MACHINE GUN.

NEW ARMY TANDEM BICYCLE.

Poisoning by Stale Eggs.

Dr. Cameron has reported the occurrence of vomiting and purging in seventy-four nuns and girl pupils in the boarding school attached to a convent in Limerick, following a dinner at which mutton and a custard composed of eggs, milk, corn flour, and sugar were eaten. The corn flour was suspected to contain arsenic, but analysis showed it to be free from poison of any kind, and to be of good quality. The sugar also proved to be pure. No other constituents of the meal could be obtained. The vomit and the stools were intensely green from the presence of biliary matter, but careful analysis failed to disclose the presence of ordinary poison. The viscera of two patients who had succumbed were also examined, but no poison was found. Ptomaines were found present, but in small quantity. The milk used had been boiled, and the meat was above suspicion. The eggs, however, were not fresh, and one presented a reddish-brown color and was thought to be bad. Some of the custard given to pigs induced severe diarrhœa.—Dublin Medical Journal.

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Discoveries in Pompeii.

The excavations at Pompeii are a continual source of interest. The new system of conservation inaugurated this year makes them doubly important. The last mansion unearthed in the buried city, whose history every one now knows so well (or ought to know), has been made the test of these improved methods instituted by the able and excellent directors. Instead of hiding away the statues, pictures, and other movable objects in the Naples Museum, as has previously been the custom, everything has been left in situ, and many objects sufficiently restored to give an idea of their original appearance. The excavation may be said to have begun in August of 1894; but the weather and lack of funds retarded the work. In November the atrium was reached; but during the winter the work progressed slowly, and the last rooms were not unearthed till June, 1895, the labors of restoration, cleaning, and preservation not being completed till August, exactly a year from the date when the first layer of earth was removed. The main entrance of the house leads into a street still blocked up with rapilli; it consists of an ostium, or passage, on one side of which sat the janitor, his little division being separated by a partition of wood that has disappeared. Facing his seat is a semi-"religious" picture, only suitable to that barbarous period of Europe's history, and which has now very properly been covered over. There were two great doors in this passage. On the outer wall of the house can be seen the remains of the iron hinge and staple that held the bar across the outer door when the house was locked up and the family had deserted it.

The room on the left of the ostium contains two small and ordinary pictures of the stereotyped kind: one represents Leander swimming across the Hellespont to Hero; the other Perseus in his ship deserting Ariadne. . . . On the opposite wall is a picture of Cephalus and his devoted wife Procris, in the form of a wounded deer, the latter being probably also represented by the woman high in the left of the same painting gazing earnestly at her husband. These pictures are let into the wall, and the prepared stucco on which they were painted was probably first laid on a board, to afford greater facility to the artist, and then, when it had dried, was inserted in the space prepared for it in the stucco on the wall's surface; the brown, yellow, or sometimes black band of paint that usually borders them hides the joining line. In the frieze is seen Leda and the swan, a bacchant with a thyrsus and a bacchante with a tambboureen, while two centaurs appear on the tops of this delicate painting. The garlands painted on the white wall, the architectural studies capped with winged sphinxes, and the cornices of red, white, and blue mouldings above and below the frieze, and separating it from the curve of the arched ceiling, add immensely to the appearance of the colors; and this elaborately painted apartment is the more attractive by the amount of brilliant red cinnabar that has been used in its decoration, and that adds considerably to the splendor of the effect.

Beyond this room, at the side of the atrium, is a side passage leading through the kitchen into the little street named by Fiorelli the Vicolo di Mercurio; in it is a staircase. Near its entrance in the atrium are the remnants of a safe, once built and riveted on a foundation of heavy stones. The iron parts are original, but the case of wood on which they are fastened is modern. Near this safe were found a bronze ring and two seals, both of iron, which are preserved in the house of the Administration of Pompeii preparatory to going to the Naples or the local museum. On one of the latter is "A. VETTI. RES. V.," and from this the house is to be called the "Casa di Vetti." On the opposite side of the atrium is another and larger safe, likewise restored. Both safes bear evidence of having been broken to pieces either by those who had dug their way down into the house, or perhaps by thieves under cover of darkness on the very night itself of the destruction of the city, when the mountain's awakened "voice at intervals" was heard roaring "through those roofless halls," and

> Temple and tower went down and left a site:
> Chaos of ruins!

A delicate little gold chain, with pearls and a few coins, besides a bronze seal with the name "P. CRVSTI. FAVSTI," were found in the highest level of earth over the rooms on the right of the atrium; but these objects may have belonged to the owner of another house, and not to the proprietor of the safes. Close to the larger of these latter is the entrance to an irregular shaped room, that contains a lararium, or altar. It stands out from the wall about eight inches, and on its sides rise two columns; between them, painted on the back of the niche sunk in the wall, is the usual picture of the two Penates or genii, and a female between them who represents either the Lar or, as some suppose, Vesta; at their feet is the tutelary genius in the form of a serpent, which is the symbol of regeneration, or of new life, accepting the offering of fruit placed before him on a small altar. The colors are wonderfully fresh, the tints are principally red, brown and yellow.

When the garden in the marble-decked peristylium is again green with shrubs, and its beds continually stocked with gay and sweet-scented flowers, the mansion will assume (except in its protecting roofs) an aspect as if the inhabitants had only just deserted it, and the earthquake had only lately taken place.—H. P. Fritzgerald Marriott, in the English Illustrated Magazine.

A Lighthouse at Cape Hatteras.

Work on the Diamond Shoal lighthouse, off Cape Hatteras, is to be begun next spring. The new plans contemplate an immense structure, built on the screw pile order, with the foundation of the light practically 100 feet beneath the wave surface and protected on all sides by hundreds of tons of riprap to prevent damage from shifting sands. Iron piles will be driven down by hydraulic pressure until a sound footing is secured, and the actual structure for the lightkeepers and materials to maintain the light will be built on the interior of the skeleton to a height of 165 feet above the water. The cost of the structure when completed is estimated at $1,200,000, and of this sum there is now available $400,000. Diamond Shoal projects into the sea seven miles off Hatteras, and is covered with from 6 to 20 feet of water. It is marked now only by Hatteras light, standing on shore seven miles from the outer edge, and not discernible in hazy or foggy weather. The proposed light will be on the extreme edge, seven miles from the nearest shore, and visible twenty-three nautical miles. The latest fog apparatus will be provided, and there will be accommodation for three keepers. It will probably take two years to complete the project from the date the work begins. When completed it will be the most notable lighthouse in the world.—Army and Navy Journal.

THE Lancet announces that a subscription has been opened in Bristol to provide for the purchase and retention in that city of the celebrated collection of relics belonging to Jenner in connection with his introduction of vaccination. The collection is at present the property of Mr. Frederick Nockler, of Wotton-under-Edge, and was exhibited by him at the Bristol Exhibition in 1893, and since then in London, at each of which places it attracted a considerable amount of attention.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR FENDER.—Charles A. L. du Quesnay, New Orleans, La. A frame secured to the front end of a car carries an inclined pivoted netted fender, the fender being curved upward at its rear end to form a protecting pillow. A spring-controlled front strand of the fender is adapted to yield inwardly, when a person is caught in the path of the moving car, and when one falls on the fender it is tilted and its front end raised to lift the feet from the ground, the head and shoulders being protected by the pillow.

CAR BRAKE.—George E. Wheeler, Minneapolis, Minn. This is a brake more especially adapted for use on street cars, requiring but little effort on the part of the motorman or gripman, and not interfering with the ordinary brake, which may be left on the car for use in case of accident. The improvement comprises a fixed and a loosely mounted bevel faced wheel on the axle in proximity to each other, and both adapted to be engaged by a conical friction wheel on a shaft connected with a hand lever extending upward through the car platform.

CAR OR VEHICLE DRAUGHT DEVICE.—James H. Turbush, New York City. This improvement provides conveniently attachable supports for the inward and outward thrust of the drawbars, the supports being rigid and constituting travelers upon which the followers may have movement, while relieving the confining strap or tie for the springs from the strain they ordinarily sustain.

CAR DOOR.—Thomas W. Bradman and Harrison Hines, Beardstown, Ill. This is a sliding exterior freight car door, on the upper part of which are hangers adapted to move upon a track, and the door is adapted to be locked in closed position by means of three bolts actuated from a central disk, the bolts being moved outward into suitable keepers at the top and two sides of the door by a crank, when a seal finger may be conveniently applied. The door is easily opened and closed, and is designed to afford effective protection to property in cars on which it is employed.

RAILWAY RAIL NUT LOCK.—Green Smith, Montgomery, West Va. This device has a base plate that may be extended or adjusted longitudinally to bring its bolt apertures into alignment with the rail and fish plate aperture, a ratchet washer having a recessed outer face receiving the adjacent face of the nut to be locked. The ratchet washers having nut receiving recesses, the improvement may be applied to any bolts and nuts now in use on railroads, or the ratchet teeth may be formed directly on the nuts where they are to be supplied with the other parts.

Miscellaneous.

BICYCLE.—Samuel A. Donnelly, Chicago, Ill. This is an improvement on a formerly patented invention of the same inventor, and the box or casing for the bearings consists of two parts, each having a radial lug and opposite inturned lip receiving and engaging the lip of the other part. An improved diamond frame also has upper and lower bifurcated truss members, each formed of a single rod doubled at its middle, the head having arms with sockets to receive the doubled ends of the members, while the saddle block, at the angle of the upper member, has angular grooves to receive the member, there being straight transverse stay rods whose upper ends enter sockets in the block, and a bolt which clamps the block to the parts in contact with it.

PROPULSION OF VESSELS.—James H. Meacham, Petersburg, Va. An endless band propeller, patented by this inventor, comprises sprocket wheels at some distance apart on each side of the vessel, the sprocket chains or bands of steel, copper, or other metal with suitable tenacity and flexibility, carrying the buckets or paddles. To avoid undue strain upon the bands, the wheels are polygonal, but are rounded instead of presenting true angles, and the paddles may be feathered.

VENDING MACHINE.—Charles W. Goldsmith, New York City. This is a coin-controlled apparatus especially adapted for delivering bulky packages, and has two pairs of oppositely arranged supports movable toward and from each other, and capable of supporting alternately crossed elongated packages, each pair of supports alternately dropping a single package for delivery. The coinway is of the usual construction, and coins cannot be inserted when the merchandise has been exhausted.

DENTAL FILLINGS.—James W. Dennis, Cincinnati, Ohio. An absorbent of mercury during the process of filling teeth with amalgam has been provided by this inventor, consisting of rubber saturated with comminuted metal having an affinity for amalgam, the material thus formed being apertured, whereby a maximum of metallic surface will be presented to the amalgam filling. The material may be made into pads or plugs of a size or shape to enter a tooth cavity, and thus facilitate making non-shrinkable metallic fillings by absorbing the surplus or loose amalgam.

LOCK.—Lewis O. Wilson, Charleston, West Va. This is an improvement in knob locks, providing a lock more easily applied to doors by simply boring a hole instead of mortising in its edge, the lock being capable of being unlocked only from the inside. The lock has a slotted cylindrical barrel in which is a spring-acting bolt with a hole, in which is arranged a retracting bar whose end extends into a slot in a frame plate on the outside of the door. A knob shaft with crank also receives the end of the retracting bar.

PHOTOGRAPH PRINTING FRAMES.—Allen E. Willis, Oxford, N. C. An automatic register for keeping tally of the number of prints in the frame has been devised by this inventor, the improvement permitting the examining of prints without disturbing the register and the proper setting of the register in case a print is spoiled. A toothed bar is mounted to slide in guideways on the print-holding back, a pawl engaging the bar, while a spring-pressed cam arm connected with the pawl is adapted to be engaged by the frame.

HAME FASTENER.—Joel P. McAhee, Erie, Ala. A connecting bar pivotally connected with one of the hame sections, according to this improvement, has a latch extension and head, while a keeper pivotally connected with the opposing section has recesses to receive the latch extension and a locking device. The improvement is especially adapted for hames having iron bands, the fastening device facilitating the connecting of the two members of the hames at the bottom around the collar and the necessary adjustment to fit any size of collar.

SLEIGH BRAKE.—Adelbert Mecham, Edinburg, North Dakota. This is an improvement on a formerly patented invention of the same inventor, providing means whereby the brakes may be strengthened and the drag bar readily lifted from the ground when it is necessary to back the sleigh. A brake bar is employed for each runner, terminating in a shoe as wide and strong as desired, and the brakes are automatically applied when the team backs, as in going down hill, the braking engagement being removed when the team pulls forwardly. In going up hill the drag bar enters the surface when the team stops.

HOSE NOZZLE.—John M. and Albert W. Dosch, Kittanning, Pa. This nozzle is forked, one of the members carrying an adjustable yoke in which is a cone, there being a three-way cock in the nozzle at the junction of its members, the nozzle being adapted for either garden or fire purposes, and providing for bringing into action instantly either a solid or a spray stream. The spray is thrown out in conical form, covering a large area, and may be conveniently made either coarse or fine.

POCKET KNIFE.—William Schmachtenberg, New York City. This is a knife in which the blades may be opened without using the finger nails, a lever fulcrumed inside the handle engaging the knife blade near its fulcrum end to swing the blade to partly open position, and this lever being moved by the shank of a button on the outside of the handle. There is a similar lever for each blade in opposite sides of the handle, a spring in the back of the knife holding the blade open or closed as usual.

SELF-CLOSING LACING HOOK.—La Roy S. Upton, Governor's Island, N. Y. This is an article adapted especially for use on shoes or gloves, and the hook is composed of two parts, a fixed base seated in the leather and having at one side a vertical arm or hook, another movable part being a lower swinging arm pivoted to the base arm and normally closing the open side of the hook. By drawing the string outwardly or laterally against the movable arm it is opened and the string disengaged, while by passing the string laterally between the open arms and drawing it taut, its re-engagement is automatically effected.

Designs.

SCARF RACK.—Homer E. Eyman, Lancaster, Ohio. This rack has convergent ornamental holders adapted to retain a number of scarfs, rising from a circular base and presenting convergent openings.

TABLE CLOTH FASTENER.—Theodore R. Desjardins, Attleborough, Mass. This is a corner piece with scalloped shell-like top portion and two spring side and bottom members for holding a table cloth in position on a table.

INSCRIPTION PLATE.—Edward K. Jones, Portland, Oregon. This is a plate to be applied to sidewalks at street corners, to receive street names, advertisements, etc., the plate having a straight back edge and a wave-like curved front edge.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

ELEMENTS OF MODERN CHEMISTRY. By Charles Adolphe Wurtz. Fifth American edition. Revised and enlarged by Wm. H. Greene, M.D., and Harry F. Keller, Ph.S. (Strasburg). With portrait of the author and numerous illustrations. Philadelphia and London: J. B. Lippincott Company. 1895. Pp. 808. Price $2.50.

Wurtz's modern chemistry is so well known and enjoys so wide a popularity that it really requires no review. Sixteen years ago the first translation was given to the American public by one of the editors of the present work. The book is now thoroughly re-edited and presents a very acceptable treatise on the science, including, we are glad to see, both argon and helium.

PRACTICAL PROOFS OF CHEMICAL LAWS. A Course of Experiments upon the Combining Proportions of the Chemical Elements. By Vaughan Cornish. London and New York: Longmans, Green & Company. 1895. Pp. xii, 92. Price 75 cents. No index.

It is an open question how far the study of chemistry can be treated inductively. It certainly seems that the student has a right to accept the work of the world of chemists, and that he should not be obliged to obtain for himself proof of many known chemical laws. But this little manual really gives an inductive treatment of a small portion of chemistry, only enough to show how the laws can be and have been proved. We note in the preface that the work has been done by pupils from twelve to eighteen years of age, spending one and a half hours at a time in the laboratory, with two weekly attendances. We certainly think the amount of inductive research given in this manual could properly and advantageously be performed by all chemical students. The work is destitute of an index.

AMERICAN ANNUAL OF PHOTOGRAPHY AND PHOTOGRAPHIC TIMES ALMANAC FOR 1896. Edited by Walter E. Woodbury. New York: Scovill & Adams Company. Pp. 370. Price 75 cents.

There can be no question but that this annual has come to occupy a leading position among publications of its character in the United States. The volume for 1896

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is replete with two hundred illustrations, many of which are reproductions of the best work by prominent amateur and professional photographers. There are articles on the applications of photography to science, such as a photographic record of sound analysis by Professor William Hallock, astronomical photography and photogrammetry and telephotography by Albert Gleaves of the U.S. A., and descriptions, with illustrations, of many useful pieces of apparatus, besides an abundance of the latest formulas for developers and lenses. It is a book of much value to the photographer desirous of keeping up with the times.

THE WONDERS OF MODERN MECHANISM. A Resumé of Recent Progress in Mechanical, Physical and Engineering Science. By Charles Henry Cochrane. Philadelphia: J. B. Lippincott Company. 1896. Pp. 402. Price $2. No index.

In this work we find presented in popular form the achievements of engineers in the many departments of science, such as building, manufacture of steel, electricity, artificial refrigerating and similar topics. Naturally, the subject is treated somewhat superficially, and perhaps for that reason is all the better adapted for the readers it is desired to reach. It is quite profusely illustrated and in many ways is really notable as being thoroughly up to date. Whatever serious value it has would have been immensely enhanced by an index.

The Scientific African.—The Scientific African is the name of a new journal, the first copy of which has just been received. Phonetically it might easily be confounded with the SCIENTIFIC AMERICAN, but the resemblance really ends there. Still this paper gives promise of a very useful existence as an exponent of South African science and technology. It is published monthly at Cape Town, Africa. The industries of South Africa are daily increasing in number and importance, and the new journal is pledged to foster these industries by illustrating and describing the various methods now in use, so as to increase the number and improve the quality of African manufactures. In addition to this, pure science is not to be neglected, as is seen by the notes on natural history, geology, anthropology, medicine and chemistry which appear in the first number. We welcome it to the brotherhood of scientific journalism.

SCIENTIFIC AMERICAN BUILDING EDITION.

JANUARY, 1896.—(No. 123.)

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1. A residence at Orange, N. J. Two perspective elevations and floor plans. also an interior view. Approximate cost $12,000. Mr. Frank W. Beall, Chicago, Ill., architect. An imposing design, and one appropriate to the location.
2. A Colonial residence, at Springfield, Mass., recently erected for Mr. W. S. Scott. Two perspective elevations and floor plans. Cost $6,000 complete. Architect, Mr. G. W. Taylor, Boston, Mass. An artistic design.
3. A residence recently erected for Rev. S. E. Smith, at Corcoran Manor, Mount Vernon, N. Y. Perspective elevation and floor plans. Cost $7,500 complete. Mr. A. M. Jenks, Mount Vernon, N. Y., architect. An attractive design.
4. A dwelling at Hasbrouck Heights, N. J. Perspective elevation and floor plans. Cost complete $3,500. S. A. Dennis, Arlington, N. J., architect. A modern and attractive design.
5. Two perspective elevations and floor plans of a country house, at Lawrence Park, Bronxville, N. Y., recently erected at a cost of $10,000 complete. Mr. Wm. A. Bates, New York City, architect. One of the most artistic and picturesque country houses in Westchester County.
6. Public school No. 9, of Erie, Pa., recently erected at a cost of $38,000 complete. Mr. Joseph Frank, Erie, Pa., architect. The design combines a striking exterior appearance and a convenient interior arrangement.
7. A half-timbered cottage of moderate cost recently erected at Glen Ridge, N. J. Architect, Mr. E. R. Tilton, New York City. A pleasing design.
8. A view of the Washington Arch, New York City. Designed by Mr. Stanford White, of the architectural firm of Messrs. McKim, Mead & White, New York City.
9. View of the new Surety Building, New York City. Total height from curbstone to coping, 314 feet, being the loftiest inhabited building in the world.
10. Miscellaneous Contents: A great bell.—Calvert Vaux.—The world's tallest structures.—Powerful dredge for the Mississippi River.—The centenary of the Institute of France.—A new corner grate, illustrated.—The "American Trackless" sliding door hanger.—The Handco "straight flush" closet, illustrated.—A simple and efficient pump, illustrated. Staining wood.—Artificial fuel.—Ancient glass makers.—House numbering.—Fires in "sky scrapers."—Non-heat conducting coverings, illustrated.—Improved wood-working machinery, illustrated.

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The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4; Munn & Co., publishers, 361 Broadway, N. Y.

Whereas, the copartnership heretofore existing in the City and State of New York between Orson D. Munn and Alfred E Beach, under the copartnership name of Munn & Co., and having its principal place of business at No. 361 Broadway, in the City and State of New York, has been dissolved by the death of Alfred E. Beach on January 1, 1896; and

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Whereas, I, Orson D. Munn, the surviving copartner, am desirous to continue the business conducted by the said copartnership and to continue the use of the name of Munn & Co.

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(Signed) ORSON D. MUNN. [L.S.]

In presence of
A. A. HOPKINS.

City and County of New York, ss:

On this 6th day of January, in the year 1896, before me personally came Orson D. Munn, to me known to be the individual described in and who executed the foregoing instrument and acknowledged to me that he executed the same for the purposes therein mentioned.

(Signed) A. A. HOPKINS,
[L.S.] Notary Public,
Kings County, New York.

Certificate filed in New York County.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

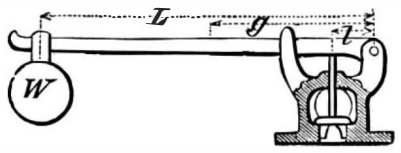
Minerals sent for examination should be distinctly marked or labeled.

(6711) F. W. B. asks for directions for making an ever-ready pad for rubber stamps: A. The following is said to be a cushion that will give color permanently. It consists of a box filled with an elastic composition, saturated with a suitable color. The cushion fulfills its purpose for years without being renewed, always contains sufficient moisture, which is drawn from the atmosphere, and continues to act as a color stamp cushion so long as a remnant of the mass or composition remains in the box or receptacle. This cushion or pad is too soft to be self-supporting, but should be held in a low, flat pan, and have a permanent cloth cover. The composition consists preferably of 1 part gelatine, 1 part water, 6 parts glycerine, and 6 parts coloring matter. A suitable black color can be made from the following materials: 1 part gelatine glue, 3 parts lampblack, aniline black, or a suitable quantity of logwood extract, 10 parts of glycerine, part absolute alcohol, 2 parts water, 1 part Venetian soap, 1-5 part salicylic acid. For red, blue or violet, 1 part gelatine glue, 2 parts aniline of desired color, 1 part absolute alcohol, 10 parts glycerine, 1 part Venetian soap, and 1-5 part salicylic acid. The following are two additional receipts used for this purpose: 1. Mix and dissolve 2 to 4 drm. aniline violet, 15 oz. alcohol, 15 oz. glycerine. The solution is poured on the cushion and rubbed in with a brush. The general method of preparing the pad is to swell the gelatine with cold water, then boil and add the glycerine, etc.

(6712) F. W. writes: I would like to ask a few questions concerning an acetylene gas plant arranged on the principle of the one described on page 8 of the SCIENTIFIC AMERICAN of January 4, 1896. 1. How large would generator bottle and receiver have to be to supply two jets that have been used for coal gas (ordinary dwelling house size). Can acetylene gas be used in such fixtures? A. You cannot use ordinary burners for acetylene. Use ⅛ foot burners. A 1 cubic foot gasholder and a 2 quart generating jar will supply them nicely. It is well to have separate inlet and outlet pipes for the holder. 2. Are the chemicals employed very corrosive? Can iron or brass connections and stopcocks be used where flexibility is not essential? A. Use ordinary fittings, avoiding brass and copper. 3. Where can calcium carbide be obtained (that is, where could I get a small amount of it)? A. Address Eimer & Amend, 305 Third Avenue, New York, N. Y. 4. Is there any more danger of explosion in acetylene gas than in coal gas? A. Not so much.

(6713) G. H. DeL. asks: 1. On a 500 volt street railway circuit, how much current does any one car take at full load? A. At 50 horse power 75 amperes could be taken. 2. I have a small bipolar shuttle armature motor, capable of driving a twelve inch fan with six small cells of plunge battery. Is there any possible way of altering the winding so as to have it act as a small generator producing enough current to light one or more miniature incandescent lights of 1, 2, 3, etc., candle power. Could you refer me to some SUPPLEMENT describing a small dynamo? A. You will have probably very little satisfaction in making the change, unless the field is of cast iron, so as to possess residual magnetism. For small dynamos we refer you to our SUPPLEMENT, Nos. 161, 599, 600, and 844. No. 599 describes a drum armature, much the best, for No. 161. 3. Having the voltage and amperage given, how can the resistance be found? The amperage and resistance to find the voltage? And the resistance and voltage to find the amperage? A. Let C= amperes, E=volts and R=ohms. Then $C=\frac{E}{R}$; $E=CR$; $R=\frac{E}{C}$. 4. What is fastest rate of speed ever attained by a locomotive in the United States? A. We refer you for items on recent railway speeds to the SCIENTIFIC AMERICAN, vol. 68, No. 20; vol. 72, No. 22; vol. 74, No. 1.

(6714) R. N. T. says: Will you give me formulas for computing the elements of a safety valve:



A. Let W = the weight.
L = distance between center of weight and fulcrum in inches.
Let w = weight of lever in pounds.
Let g = distance between center of gravity of lever and fulcrum in inches.
Let l = distance between center of valve and fulcrum in inches.
Let V = weight of valve and spindle.
Let A = area of valve in square inches.
Cet P = pressure at which the valve is to blow off, per square inch.

Then the weight required to balance a given pressure at any given distance on the lever will be by the formula:

$$W = \left\{ (P \times A) - \left(V + \frac{(w \times g)}{l} \right) \right\} \times \frac{l}{L}$$

When the weight is at hand and known, and the distance is required, then

$$L = \left\{ (P \times A) - \left(V + \frac{(w \times g)}{l} \right) \right\} \times \frac{l}{W}$$

The elements between the brackets to be computed first. To obtain the area of the valve, multiply the square of the diameter by 0·7854.

(6715) D. P. D. says: Please let me know, through the SCIENTIFIC AMERICAN, how to put a ¼ in. hole through a heavy glass bar? A. This can be done with a hard drill and spirits of turpentine—a tedious and uncertain process, and only for small holes. A diamond drill is much better and cheaper, if there are many holes to drill. If large holes are wanted, from ¼ in. to 1 in., or larger, prepare a piece of thin tubing of brass or copper, of the required size of hole, of 1 or 2 in. in length, with small spindle and grooved pulley attached, something after the style of the watch maker's bow drill. Fasten upon the plate of glass, at the point to be drilled, a ring of metal or wood for a guide to keep the tubular drill in its place, until the cut is started sufficiently to steady the cutter. Lay the glass plate horizontally, and work the drill perpendicularly with the bow, using one hand to steady the upper end of the drill stock. Feed emery (about No. 90) and water into the open end of the tube as fast as required. In a very short time you will cut a disk out of the plate. Another plan is to heat the drill to a low cherry red and plunge in a solution of chloride of zinc (soldering fluid). This gives the drill an exceedingly hard edge; grinding removes the hard portion. Therefore, the drill must be hardened after grinding.

(6716) C. J. M. asks how to make leaf photographs. A. Pass the paper first through a solution of gelatin, 1 part in 20 parts of hot water, and use a strong solution of potassium bichromate; or the gelatin and bichromate may be used together. Wash with hot water. A strong blue blackground may be produced as follows: Dissolve in 2 oz. of pure water 120 grn. of red prussiate of potash (potassium ferrocyanide), and separately 140 grn. double citrate of iron and ammonium in 2 oz. of water; mix the solutions, filter, float the paper for a few minutes on the filtrate; print from the dried paper as before, and wash thoroughly in water. By adding a little phosphoric acid to the bichromate solution and exposing the print before washing to the vapor of a hot solution of aniline in alcohol, a blackish-green or red positive is obtained. Or, prepare the paper with solution of iron sesquichloride, and develop after exposure with a very dilute solution of silver nitrate. Use plain photographic paper.

(6717) G. D. H. says: Can you give me simple rules for calculating the speed of pulleys? A. The diameter of the driven being given, to find its number of revolutions.

Rule.—Multiply the diameter of the driver by its number of revolutions and divide the product by the diameter of the driven; the quotient will be the number of revolutions of the driven.

Ex.—Twenty-four in. diameter of driver × 150, number of revolutions, = 3,600 ÷ 12 in. diameter of driven = 300.

The diameter and revolutions of the driver being given, to find the diameter of the driven, that shall make any given number of revolutions in the same time.

Rule.—Multiply the diameter of the driver by its number of revolutions, and divide the product by the number of required revolutions of the driven; the quotient will be its diameter.

Ex.—Diameter of driver (as before) 24 in. × revolutions 150 = 3,600. Number of revolutions of driven required = 300. Then 3,600 ÷ 300 = 12 in.

The rules following are but changes of the same, and will readily understood from the foregoing examples:

To ascertain the size of the driver.

Rule.—Multiply the diameter of the driven by the number of revolutions you wish to make, and divide the product by the required revolutions of the driver; the quotient will be the size of the driver.

To ascertain the size of pulleys for given speed.

Rule.—Multiply all the diameters of the drivers together and all the diameters of the driven together; divide the drivers by the driven; the answer multiply by the known revolutions of the main shaft.

TO INVENTORS.

An experience of nearly fifty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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January 28, 1896,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

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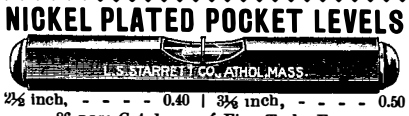

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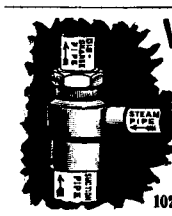

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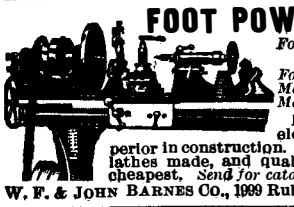

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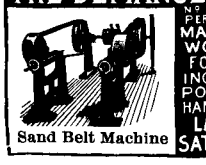

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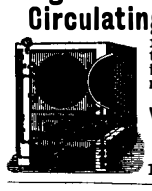

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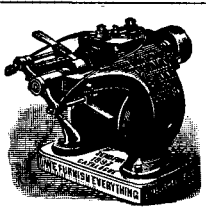

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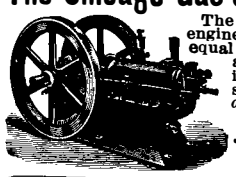
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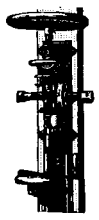
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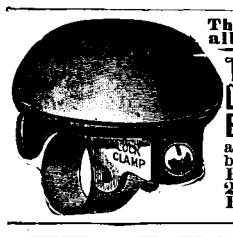
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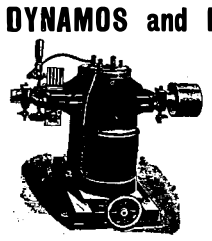
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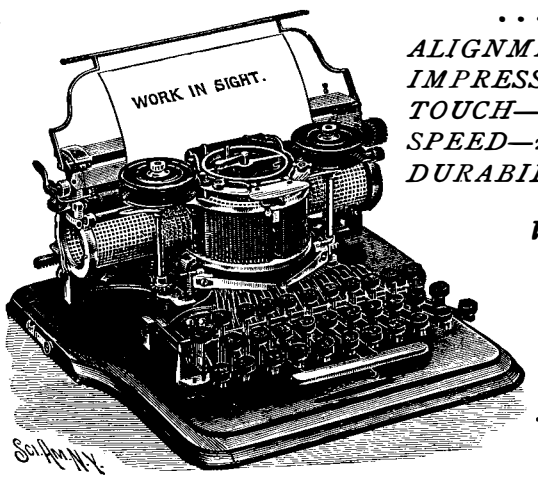

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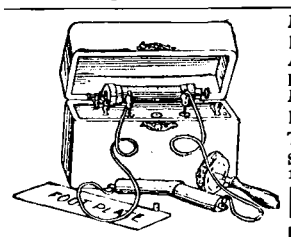
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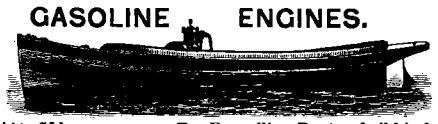
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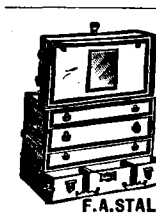
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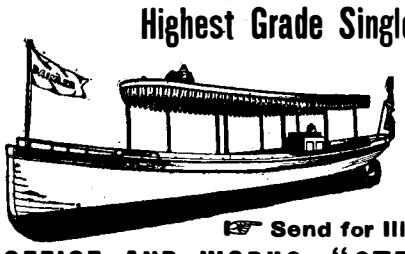
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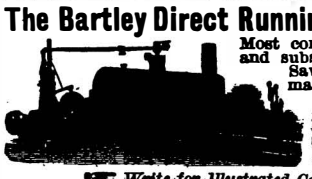

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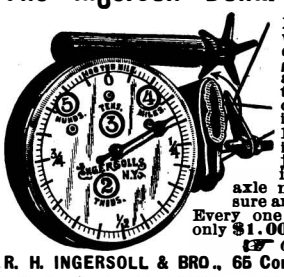

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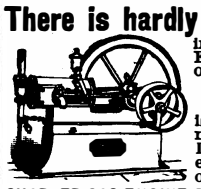

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